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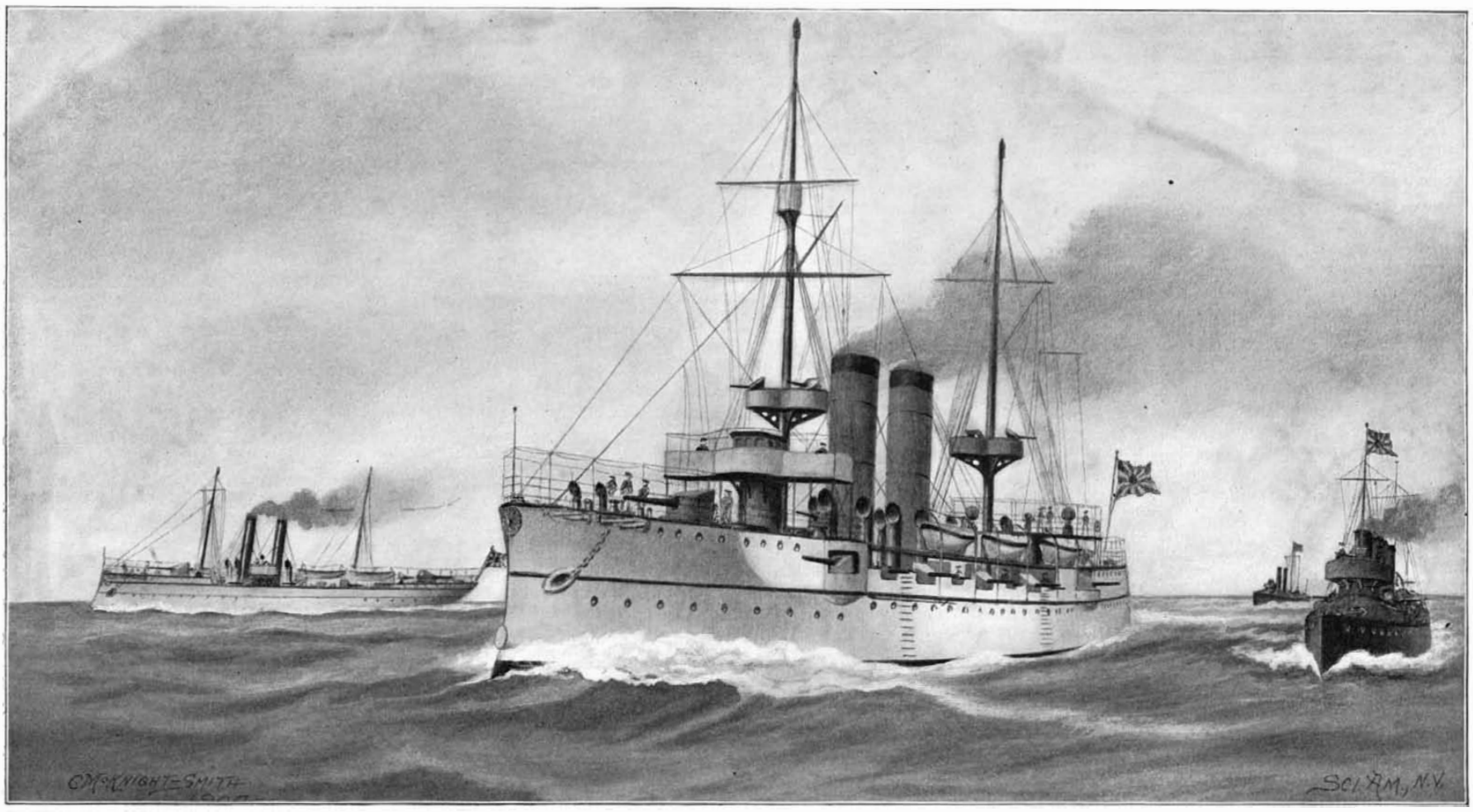
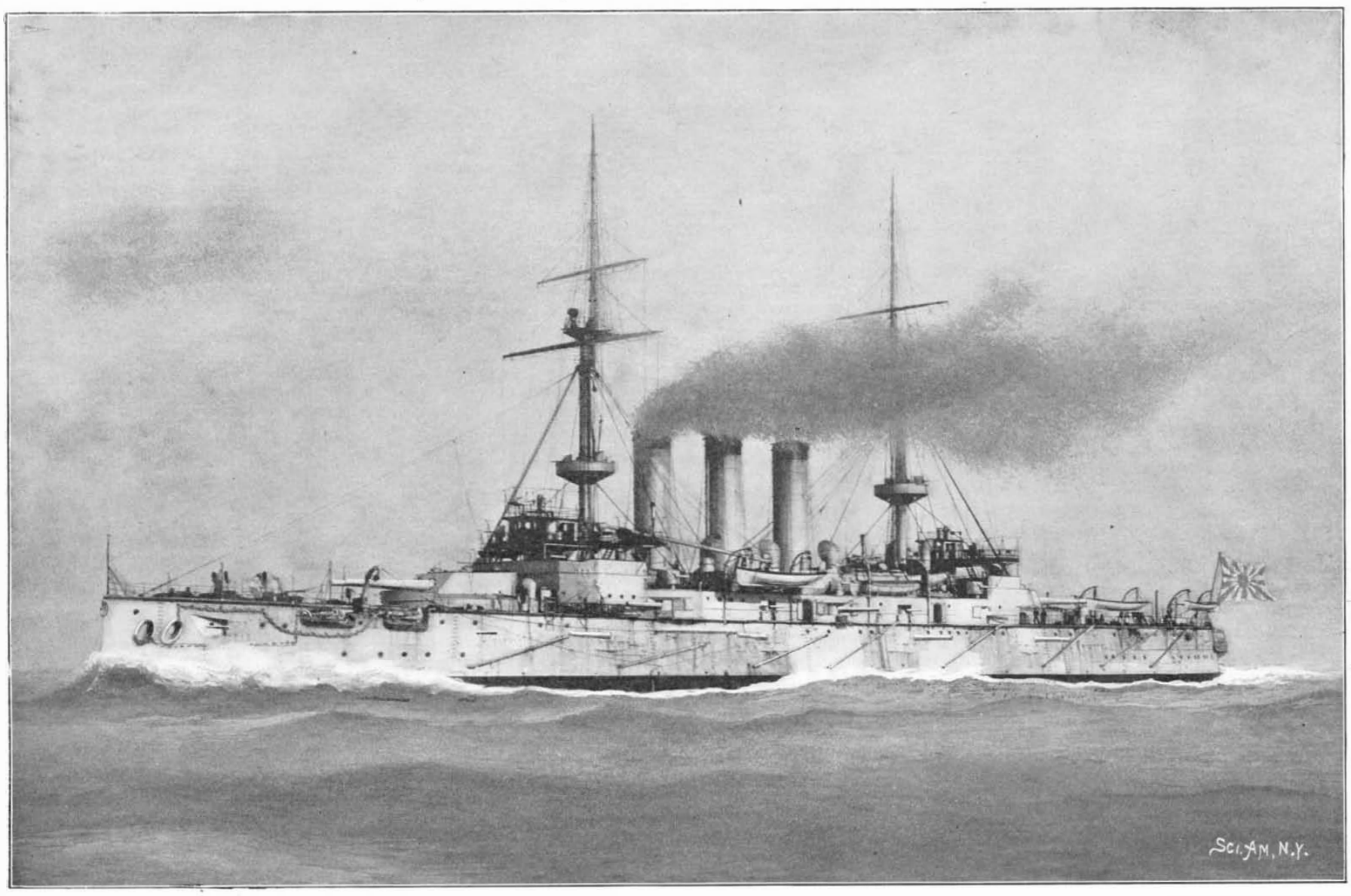


FROM LEFT TO RIGHT: TORPEDO GUNBOAT "MIYAKO"; Displacement, 1,800 tons; **Speed,** 20 knots: sunk by mine. **PROTECTED CRUISER "YOSHINO"; Displacement,** 4,150 tons; **Speed,** 23.08 knots; rammed and sunk. **TORPEDO BOAT No. 48; Displacement,** 135 tons; **Speed,** 27 knots; sunk by mine. **TORPEDO BOAT DESTROYER "AKATSUKI"; Displacement,** 385 tons; **Speed,** 31 knots; destroyed by shell.



Displacement, 15,000 tons. **Speed,** 19.1 knots. **Complement,** 741.

Battleship "Hatsuse," Sunk by a Mine, With Loss of 450 Men.

THE JAPANESE NAVAL DISASTERS.—[See page 438.]

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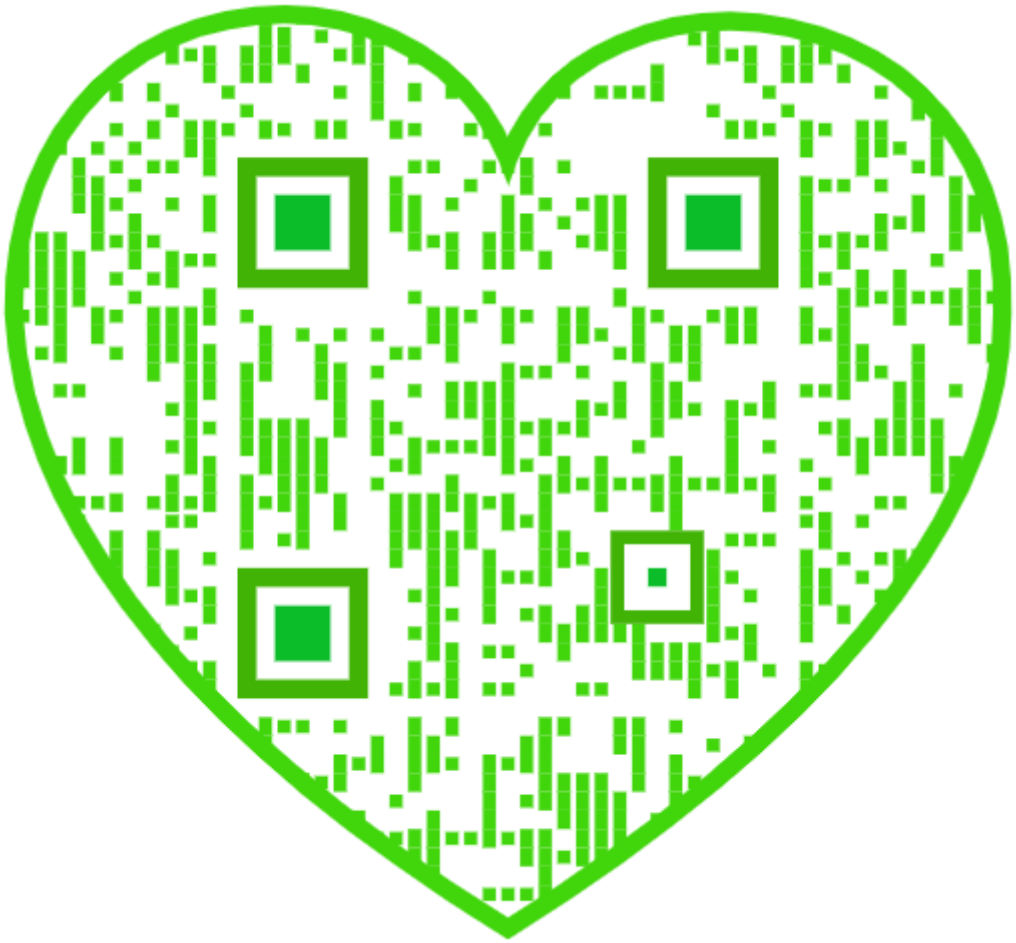

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NEW YORK, SATURDAY, JUNE 4, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE N-RAYS: ARE THEY REAL OR ILLUSORY?

Just why English and German scientists have been uniformly unsuccessful in detecting the strange emanations to which Prof. Blondlot, their discoverer, has given the name "N"-rays, and why French physicists, on the other hand, furnish more convincing proof of their existence every day, is one of those scientific anomalies for which no adequate explanation can ever be offered. French eyes are certainly blessed with no greater clarity of vision than those of Englishmen; and yet the fact remains that Blondlot's rays, or at least the more important phenomena of which they are the cause, have never been observed by any but Blondlot, Charpentier, and a few French investigators. The prompt reply with which each objection to the existence of the N-rays is met by Blondlot in the form of experimental proof, and particularly the photographic evidence of N-ray activity that is now offered, would seem sufficient to dispel whatever doubts may still linger.

What the N-rays are has not been determined with any greater certainty than has attended similar inquiries into the nature of the Roentgen rays. Only their effects have thus far been studied. How the emanations were discovered is probably well known to readers of this journal who have followed the accounts that we have published from time to time of Blondlot's work. A brief recapitulation, however, may not be out of place.

In his experiments on the rapidity of propagation of the Roentgen rays, Blondlot noted effects that could be explained only by assuming the existence of undiscovered radiations. Experiments with other bodies than a Crookes' tube confirmed that assumption. A Welsbach burner, a Nernst lamp, flint exposed to the sun's rays, rapidly-vibrating sonorous bodies, the sun, and many other substances were found to be radioactive, to give off rays that resemble both heat-waves and Roentgen rays—heat waves in so far as the rays were absorbed by the slightest film of water, Roentgen rays in so far as they penetrated aluminium with ease. By far the most startling announcement that has been made by any investigator who has made the N-rays a special study, comes from Charpentier, who boldly proclaims that the human body sends forth N-rays. That it should be possible to measure the force exerted in muscular contraction, to note the activity of the brain and nerve centers, and, indeed, to trace by substances rendered phosphorescent, the general arrangement of nerves in the human system, seems more like a fantastic Jules Verne dream than a scientific achievement. And yet this is what Charpentier claims that he has done.

In Great Britain and Germany, as we have said, the existence of these puzzling emanations has been boldly denied. At the University of Glasgow seven skilled observers of one experiment were unable to note any of the characteristic phenomena of the rays. In Germany, Prof. Lummer has ingeniously shown that many of the Blondlot experiments can be imitated without employing any of the means prescribed by Blondlot, and that the effects observed may be referred to processes taking place in the eye itself. It has also been suggested that the dilation of the pupil, which occurs when the attention is fixed upon an object, may account for the peculiar manifestations recorded by Blondlot and Charpentier. A well-known British scientist offers the fanciful explanation that self-hypnotism due to the fatigue of the optic nerve is the cause of the N-ray phenomena. In a word, most if not all of Blondlot's opponents seek to account for the N-rays by classing them with optical illusions or by considering them purely subjective perceptual processes.

However plausible these theories may be, they most certainly fall before the incontestable proof afforded by means of objective instruments of precision. Blondlot has demonstrated the existence of his N-rays by photography. Furthermore, he has actually measured the wave length of the rays both by means of the diffraction grating and Newton's rings. Surely it cannot be contended that the photographic plate is subject to hallucinations; nor can it be said that optical illusions have measurable wave-lengths.

If the N-rays do exist, what are they? A satisfactory answer cannot be given until we know more of radioactivity, and until the information thus gathered has been properly classified. The Roentgen rays were discovered several years ago. And yet, how much of their true nature do we know. Even the radio-active substances discovered long before radium burst upon us are still puzzles.

If the N-rays are still but little understood, we may nevertheless attempt to classify them with other undulatory phenomena. It will be remembered that by means of the old periodic law of chemistry it was possible to tabulate the chemical elements according to their properties and their atomic weights in a sequence that brought out their relation to one another strikingly. Wherever gaps occurred, it was reasonable to infer that they would be filled by elements still to be discovered—an inference that was more than once justified. By a similar tabular arrangement, the N-rays may be shown to fill a gap in the series of undulatory rays. In rate of vibration and length of wave there is a difference so vast between the shortest electrical waves (0.60 millimeters) and the longest heat waves (0.024 millimeters) that the N-rays with their average wave length of 0.2 millimeters may well be assumed to fill the intervening gap.

SUBMARINE MINES ON THE HIGH SEAS.

It is the opinion of a well-known officer of the United States navy, a leading expert on the subject of submarine mining, that both the Russians and Japanese have been sowing the waters in the neighborhood of the Liao-tung peninsula with submarine mines on a most extensive scale, each of the combatants aiming to render the harbors and roadsteads and the courses that would naturally be followed by the enemy's warships so perilous that they would either keep clear, or if they did venture into these waters, would do so at the imminent peril of losing their ships.

That such a policy has been followed with reckless abandon is suggested by the fact that during the present war no less than eight vessels, from the 15,000-ton battleship down to the small torpedo boat, have been either disabled or entirely destroyed by contact with mines. On the part of the Russians, as far as can be made out from dispatches, the torpedo cruiser "Yenesei," the protected cruiser "Boyarin," a torpedo destroyer or a torpedo launch, and the battleship "Petropavlovsk" have been utterly destroyed by these deadly weapons, while the "Pobieda" was so badly injured as to have difficulty in getting back into the shelter of Port Arthur. The Japanese acknowledge that they have lost by the same instrumentality a torpedo boat, the protected cruiser "Miyako," and the battleship "Hatsuse."

Both the Russians and Japanese freely admit that they have resorted to mine laying, the latter claiming that the "Petropavlovsk" was sunk by mines that were placed for the express purpose of intercepting Admiral Makaroff's fleet on its way out through a certain channel that led from Port Arthur. It seems also to be pretty well established that one form of mine that has been freely employed makes use of connecting cables between two or more separate floating mines, the idea being that if the ship does not happen to hit the mines themselves, her stem will engage the connecting cable, and as she moves forward through the water, the mines will be swung in against her hull and explode on contact. There is strong confirmation of this in the fact that in the sinking of both the "Petropavlovsk" and the "Hatsuse" there seem to have been two explosions at different points of the ship's length, the second following very closely upon the first, which is exactly what would happen if a ship steered across the cable, and drew the mines in upon herself, particularly if her stem engaged the connecting cable at some other point than midway between the two mines. Now the fact that this double explosion occurred in the case of both the Russian and Japanese battleships, would indicate either that both contestants are using the same form of mines, or that the loss of both battleships is to be attributed to a Japanese source. It is more than probable, however, that immediately upon the loss of the "Petropavlovsk," the Russians set about doing what the Russian press has persistently asserted was done, namely, sowing the waters frequented by the Japanese in their bombardment with mines which were laid by torpedo boats under cover of the night.

It is probable that these mines have been anchored and that in the heavy storms which have been frequent of late, many of them have broken adrift and floated far outside the immediate theater of war. According to Admiral Togo's report, the "Hatsuse" was sunk ten miles off shore. It is unlikely that the mine which sunk her was anchored, for the chance of a vessel steering directly over such a small floating object, anchored far outside the range at which she could use her guns effectively, was so remote that the Russians would not consider the chance worth the time and risk that it would take to place a mine in such a spot. No doubt this particular mine, like the two which were seen floating within three miles of the port of Wei-Hai-Wei, over eighty miles from Port Arthur, by a correspondent of the London Times, was one of the derelicts that had broken adrift.

Immediately upon the sinking of the "Hatsuse," it was announced from Tokio that the Russians were sowing floating mines upon the high seas outside of the three-mile limit. The matter was taken up in the British press, and Russia was charged with violating the unwritten principles of international law as it affects the rights of neutrals on the high seas. We must confess that common fairness demands that no such charge be made until it has been absolutely proved that this has been done. It is well, however, that the point has been raised; for there is no question that scores, and possibly hundreds, of these terrible weapons have either broken loose or been deliberately cast loose, to float out on the high seas where they must, for many months, and possibly years, remain as a deadly menace to ships of all nations. It will probably never be known whose ships were blown up by whose mines, or what character of mines have been laid by whom, or where or how they were laid; but the terrible menace which undoubtedly exists will, we hope, lead to some international regulations that will put a strict limit upon the uses that are to be made by belligerents of this method of warfare.

Now that it is certain that an unknown number of mines, any one of which would be certain destruction to a merchant vessel, have been floated out onto the high seas, to be carried by wind and weather Heaven knows where, the question arises as to the length of time during which they will retain their deadly efficiency. The United States navy has some experience on this subject, purchased happily at no cost to itself; for when our ships were entering various harbors of Cuba during the Spanish war, no less than three of our vessels came in contact with Spanish mines which, most fortunately, had been clogged by the marine growths, which accumulate so rapidly in tropical waters. These mines were provided with projecting levers which, upon being struck by a ship, should have acted with a trigger-like effect and discharged the mine. There are two of these mines on exhibition to-day at the New York navy yard. Although they had been but a few months in the water, they were so incrusted with barnacles that the triggers refused to work, and our ships escaped. Many mines, however, are not dependent upon any projecting levers for detonation, the outer case being entirely free from openings, and the firing mechanism being contained within the water-tight shell; and there is no reason why, especially in the colder waters of northern seas, such a mine should not retain its efficiency for the probable duration of an ordinary war, say for one or two years. In course of time the high explosive, through chemical changes, will lose its efficiency, and ultimately the salt water will attack the shell and leakage will take place. It can safely be said, however, that for at least twelve months to come, the world at large may thank the contestants of the Russo-Japanese war for having set afloat on the high seas a tremendous peril to navigation; and we repeat, that the United States could not do better than improve the present opportunity to bring about a thorough discussion of this subject, with a view to rigidly circumscribing the area—the accidental as well as the intended area—of mining operations and risks.

A WORLD'S CONGRESS OF ACADEMIES.

The first meeting of the General Assembly of the International Association of Academies was held, it may be recalled, at Paris in 1901, under the presidency of M. Gaston Darboux, permanent secretary of the Académie des Sciences. That gathering, by a unanimous vote, decided that the next triennial Congress should take place in London, the prospective date being of course coincident with the present year. Subsequently, Whitsun-week was decided upon as the most convenient period to call the assemblage together in England, and the arrangement was made that the gathering should be under the presidency of Sir Michael Foster, the distinguished physiologist.

The establishment of this important association was not, it may be said, trumpeted among the nations; on the contrary, its birth was accomplished in so quiet a fashion that some may feel surprise when reminded of the circumstance of its foundation. However that may be, it is the fact that the subsequent progress of time, though comparatively short, has secured for the organization a unique power and influence, amply justifying the early hopes that centered around its initiation, and the original efforts to launch it as a cosmopolitan undertaking. Once ushered in, it sprang into prominence, and is now a notable force in movements affecting the progress of science and learning.

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The idea for an amalgamation of this kind was not, however, of one-man inception; rather, it lay in the gradual growth, shaping, and ripening of aspirations long cherished by many men of science desirous of achieving some definite international reciprocity for the better advancement of scientific or philosophical schemes of general utility.

Foremost among those thus animated were the leaders of the four academies of Göttingen, Leipzig, Munich, and Vienna. They constituted some years ago an association called a "Cartell," a body which sent representatives from each academy, and which met regularly and in turn at the above cities for the discussion of matters of the hour, as well as to take decisions involving common action. Later on—to be precise, in 1899—the Royal Society of Göttingen invited its sister society of London to send delegates to participate in that year's Cartell. This was chiefly prompted by the fact that the project for a grand catalogue of scientific literature which the latter was then promoting was to come up for discussion. Following this invitation, the whole Cartell asked the Royal Society of London if it would join the existing association, an appeal which led ultimately to the adoption of a wider basis of organization and the adhesion, one by one, of the principal academies of the world, represented in all cases by the sections of Science and of Letters wherever these formed an integral part of the respective institutions.

By the statutes that are in force, during the triennial intervals of the General Assembly, the business of the association is conducted by an international council, this being under the guidance of one of the constituent academies, and denominated the "directing academy." Since the Paris meeting, the Royal Society has acted in the latter capacity, but will now transfer the duty to such other academy as may be nominated by the vote of the Assembly. In all likelihood the Imperial Academy of Vienna will be selected for this onerous assumption of duty.

The international character of the association is seen in the category of cities from which the academies hail. They include Amsterdam, Berlin, Brussels, Budapest, Christiania, Copenhagen, Göttingen, Leipzig, London, Madrid, Munich, Paris, Rome, St. Petersburg, Stockholm, Vienna, and Washington. In the case of London, it is just now of interest to record the names of the delegates acting in the two sections. The Royal Society has chosen a distinguished band, namely, Sir William Huggins, Lord Kelvin, Sir William Ramsay, Sir Norman Lockyer, Sir David Gill, Prof. Larmor, Prof. H. E. Armstrong, Prof. G. H. Darwin, Prof. Forsyth, Prof. Liversidge, Mr. F. Darwin, Dr. Waller, Mr. A. B. Kempe, Prof. Schuster, and Mr. W. Bateson; while, similarly for letters, the British Academy for the Promotion of Historical, Philosophical, and Historical Studies sends Lord Reay, Mr. James Bryce, Sir Richard Jebb, Dr. Caird, Sir Courtney Ilbert, Sir Alfred Lyall, and Prof. Rhys Davids. This latter and newly-created body now fills the void so confessedly apparent at the Paris Assembly of 1901 through the hitherto non-existence of any organization of the kind in England, and it will join forces with the Royal Society in welcoming the Witenagemot.

From the composition of the list of foreign scientists and men of letters who have been authorized to attend the Assembly, it is evident that the best thought and culture of the several countries concerned will be represented in the conclave. For example, to specify only a few among many eminent names, the French Institute depute M. Mascart, president of the Academy of Sciences, and M. Gaston Darboux, permanent secretary, together with Prof. Moissan, the Count de Franqueville, Baron de Courcel, and M. Georges Perrott; Berlin will send Prof. W. von Bezold; Belgium, the Chevalier Descamps, president of the Belgian Academy of Sciences; Madrid, Prof. Ramon y Cajal; Stockholm, Prof. Gustav Retzius; Vienna, Prof. Viktor von Lang; and so on, through a long list of notabilities.

The United States is represented in the Assembly by the National Academy of Sciences of Washington, but we chronicle the very regrettable circumstance that no delegate has been found whose engagements would permit the short visit across the Atlantic to participate in the deliberation of the Congress. The breach has been filled by the nomination of two English members on the roll of the National Academy, namely, Sir Archibald Geikie, late Director-General of the Geological Survey of Great Britain, and Prof. Ray Lankester, the Director of the Natural History Museum. None the less is the loss of direct representation to be deplored, especially as Prof. Lincoln Goodale, delegate from Harvard, was an enforced absentee, through indisposition, on the occasion of the first meeting in 1901.

The business that will be dealt with at the meeting of the Assembly in London is of a varied character. A report will be furnished by Sir David Gill on the great work proceeding in South Africa appertaining to the measurement of the geodetic arc from the Cape to Cairo; there will be a discussion on a comprehensive scheme for the furtherance of seismological investigation; and one on the report of a special commission instituted by the association for the purpose of promoting the study and investigation of the anatomy of the brain. The Royal Academy of Sciences, Berlin, intend to move for the nomination of a committee charged to consider the question of securing magnetic observations at sea, with the view to an extended magnetic survey. American scientists in particular will watch with interest the outcome of a matter which will be brought up. A resolution was arrived at some time ago at Turin, by the International Congress of Physiologists, expressive of the desirability of the laboratory on Monte Rosa being recognized as an international establishment, to be carried on for the benefit of science, under the auspices of the Association of Academies. This proposition has received the joint support of the National Academy of Sciences, Washington, and of the Reale Accademia dei Lincei, Rome. It is, however, expected to provoke considerable discussion. At present the Association of Academies has no funded property, relying for support upon its collective subscriptions, so that in order to provide maintenance for this or kindred projects it must obtain donations or subventions from states, both of which courses are naturally fraught with some difficulty. So strongly is this felt by the Royal Society, that Sir Michael Foster will propose the following resolution relating to scientific undertakings: "That the initiation of any new international organization, to be maintained by subventions from different states, demands careful previous examination into the value and objects of such organization, and that it is desirable that proposals to establish such organizations should be considered by the International Association of Academies before definite action is taken."

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

There is still rather a lack of news in the astronomical world. Nothing more remarkable than the discovery of a new comet has been recorded during the past month. This is so frequent an event that it is usually hardly deserving of comment; but the present comet—discovered by Brooks at Geneva, N. Y., on April 16—may turn out to be unusually interesting, as it appears that it may have a very short period.

When a comet is discovered, the first efforts of astronomers are naturally directed to obtaining accurate observations of its position. When enough of these have been obtained, the elements of the comet's orbit can be calculated, and from these its future motion can be predicted.

It is theoretically possible to determine a comet's orbit from any three observations; and if the observations were perfectly correct, the results of the calculation would give us the true orbit. But actual observations are inevitably affected by small "accidental" errors, and an orbit calculated from three of them will represent, not the true places of the comet at the time of observation, but the slightly erroneous recorded places. Now in many cases, especially when the intervals between the dates of observation are short, it may require large alterations in the elements of the comet's orbit to produce these small changes in its calculated positions for the given times, so that an orbit calculated from only three observations (though the numerical work is perfectly correct) may nevertheless be considerably in error.

In such a case, the predicted positions of the comet will diverge more and more rapidly from the true ones as time goes on. But as more observations are obtained, the preliminary orbit can be corrected, and a new one found which represents all the observations up to date pretty closely, instead of agreeing exactly with three, and not at all with the later ones. As the interval since the discovery, and the number of observations, increase, the influence of the accidental errors of observation becomes much smaller. But it is usually not worth while to try to predict the comet's motion for more than a month ahead, until several weeks' observations are available upon which to base one's calculations. (It may be said in passing that this fact makes it difficult to give satisfactory accounts of the movements of new comets in a series of articles like the present, which must be prepared some time before publication.)

For the reasons just given, it appears that the preliminary orbits calculated by two different astronomers for the same comet may differ a good deal, though neither one has made any mistake in his computations. The errors of observation are responsible. But there is an additional cause for discrepancies. Most comets move in parabolic orbits, coming from distant space, swinging around the sun, and returning in the direction whence they came, not to return for many centuries, if at all. A respectable minority, however, move in elliptical orbits, and return regularly, sometimes in periods of only a few years. A parabolic orbit is easier to compute than an elliptical one, so most computers usually assume at first that a new comet is moving in such an orbit.

The chances are that this assumption will prove to be nearly right, and if it proves to be wrong, new elements can then be easily calculated.

Several astronomers have computed parabolic orbits for Brooks' comet, which agree in giving a perihelion distance about 2½ times the radius of the earth's orbit, though they show minor differences, due no doubt to the observational errors.

On the other hand, Dr. Leuschner, of the University of California, has computed an elliptical orbit from three observations, and reaches the very remarkable result that the comet's orbit is nearly circular, with a period of about three years. This is shorter than the period of any known comet, and, if further observations confirm these calculations, Brooks' comet will take its place among the most remarkable of such bodies. But Dr. Leuschner expressly states that in this case the errors of observation may have a large effect, and so there will be no reason for surprise if the period of the comet turns out to be actually a good deal longer.

The comet is of about the ninth magnitude, and is growing fainter. While beyond the reach of a field-glass, it is well placed for telescopic observation, being on the borders of Draco and Boötes, with a westerly motion toward Ursa Major. It is being carefully observed, and before long the true character of its orbit will be known.

THE HEAVENS.

The principal constellations which are visible at nine o'clock in the evening in the middle of June are as follows:

Cassiopeia is low in the north under the pole, Cepheus lies above, and to the right is Cygnus, lying in the Milky Way, with Lyra above it, marked by the brilliant Vega. Below on the right is Altair, the principal star of Aquila. Though there are no particularly bright stars to the south of this, the Milky Way is very conspicuous, and full of bright knots and patches.

Just south of east is Scorpio, with the ruddy Antares at its heart, and the long line of the tail curving down to the horizon and bending up again. The region west of this is barren, but higher up, near the meridian, is Boötes, with Arcturus blazing brilliantly. Between this and Vega are Corona and Hercules. Virgo lies southwest of Boötes, and its principal star, Spica, is the brightest in that part of the sky. Farther west is Leo, which is now sinking rapidly toward the horizon, and preparing to follow Gemini, whose last stars are disappearing in the northwest. Ursa Major lies north of Leo, and Ursa Minor and Draco are on the meridian above the pole.

THE PLANETS.

Mercury is morning star in Taurus, and reaches his greatest elongation on the 8th. At this time he rises an hour before the sun, and may be seen low down in the east in the dawn; but he is south of the sun, and this is not a favorable apparition.

Venus is morning star in Taurus and Gemini, but is too near the sun to be seen with the naked eye.

Mars is also morning star, and too near the sun to be seen, so that his conjunction with Venus on the 19th is unobservable.

Jupiter is morning star in Pisces, and rises before 3 A. M. on the 15th, so that he is conspicuous in the morning sky.

Saturn is in Capricornus, and comes to the meridian about 4 A. M.

Uranus is in Sagittarius, and comes into opposition on the 19th. His position on the 2d is R. A. 17h. 54m. 7s., dec. 23 deg. 38 min. south, and on the 30th R. A. 17h. 49m. 12s., dec. 23 deg. 38 min. south. As his motion between these dates is nearly uniform, it will be easy to find his exact place on a star-map. He appears as a greenish star of the sixth magnitude, just visible to the naked eye on a clear dark night.

Neptune is in conjunction with the sun on the 27th, and is invisible throughout the month.

THE MOON.

Last quarter occurs at midnight on the 5th, new moon at 4 P. M. on the 13th, first quarter at 10 A. M. on the 20th, and full moon at 3 P. M. on the 27th. The moon is nearest us on the 17th, and farthest off on the 5th. She is in conjunction with Saturn on the 4th, Jupiter at 3 A. M. on the 9th, Mercury on the 11th, Venus and Mars on the 13th, Neptune on the 14th, and Uranus on the 26th. Only the conjunction with Jupiter is close.

Cambridge, England.

CHARLES H. HASWELL'S NINETY-FIFTH BIRTHDAY.

America's oldest living engineer, Mr. Charles H. Haswell, celebrated his ninety-fifth birthday recently as a guest of the Engineers' Club in New York city. Despite his advanced years, Mr. Haswell is still actively engaged in his profession, and appears every day in the City Hall of New York at his desk. He is the assistant engineer of the Board of Estimate, and has been in the service of the city for many years. Mr. Haswell was the first chief engineer of the United States navy. He had the distinction of seeing the "Clermont" make her first run up the Hudson River.

The SCIENTIFIC AMERICAN extends its congratulations to Mr. Haswell.

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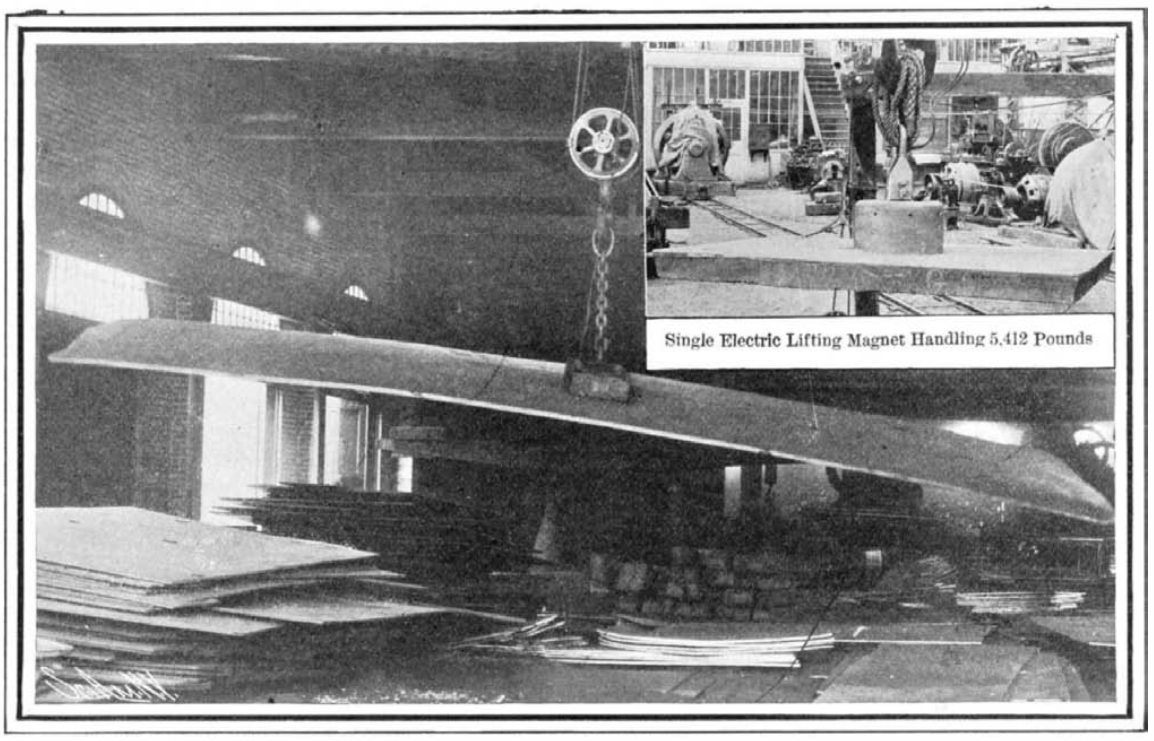
BELGIAN AND AMERICAN ELECTRIC LIFTING MAGNETS.

BY FRANK C. PERKINS.

The construction of an electro-magnet for lifting heavy pieces of iron and steel, and the design of the same, would seem to present no great difficulties; but up to the present, but few manufacturers have been successful in placing apparatus of this type on the market for this class of work. Lifting magnets have been designed by engineers in this country for handling steel plates and billets. These are now in operation at the works of the Otis Steel Company, as well as other iron and steel plants, and have given excellent satisfaction. These lifting magnets were designed and constructed by the Electric Controller and Supply Company, of Cleveland, Ohio. At Liege, Belgium, the electrical engineers of the Electrical works of the Compagnie Internationale d'Electricité, claim to have produced a most perfect electric lifting magnet for use in rolling mills, foundries, and iron and steel works, the accompanying illustration showing the type and method of operation of this class of apparatus.



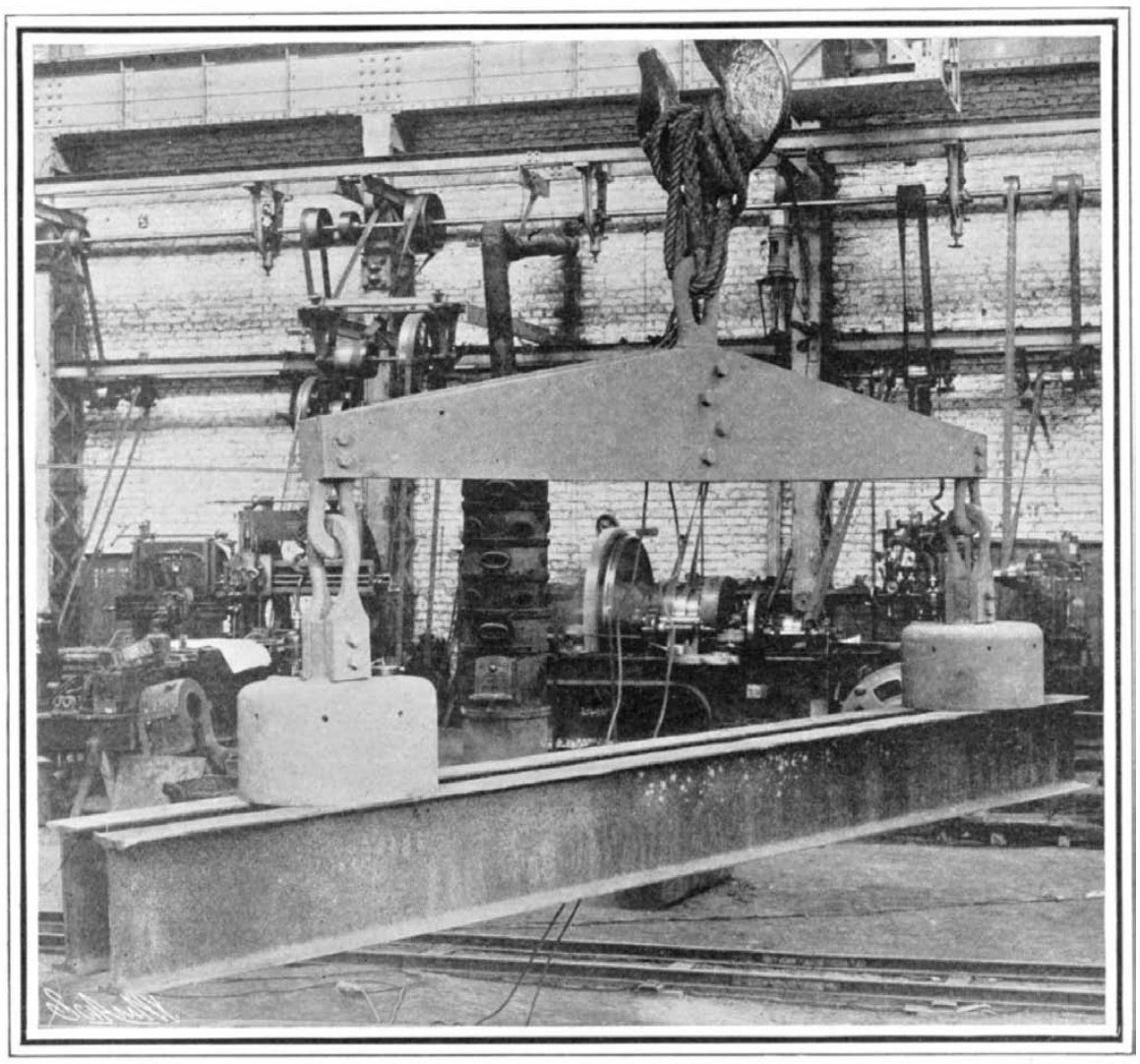
AN AMERICAN PLATE-LIFTING ELECTRO-MAGNET.

The electro-magnet, when well designed and constructed, and successfully operated, has an advantage over the old method of lifting of saving a vast amount of manual labor and a great deal of time. Ropes and chains have always been employed heretofore for attaching the load to the hook of the crane, and this required the services of at least two or three men, on account of the heavy and awkward pieces of metal that have to be carried from one part of the foundry or iron and steel works to another.

By means of the electro-magnet, all of the operations are carried out by the attendant on the crane, entirely doing away with the ropes and the man required to fix the tackle. The crane driver simply lowers the magnet on to the piece of metal to be lifted, and excites it by means of the switch, which is placed near at hand. The driver lowers the load, and when it reaches the spot where it is desired, the current from the magnet is switched off, and the hook and magnet are again raised by the crane, and moved along for the next load.

A load may be picked up in an exceedingly short time, only two or three seconds being required for sufficiently magnetizing the lifting magnet, and the enormous saving thus made allows a greater output for each crane, so that fewer cranes are required to do the same amount of work. While it is a fact that there is a greater consumption of power, the amount of current used is so insignificant as to be hardly worth mentioning. An electro lifting magnet which is capable of sustaining 2½ tons, according to the data given by the Belgian engineers, requires about 750 watts.

At Liege there are two types of lifting magnets constructed, the single and the double, the latter being simply composed of two of the single-type magnets, one fixed at each end of a beam, which is suspended at the center from the crane hook. The International electro lifting magnet consists of two parts, the outside bell-shaped cover and the magnet proper, or coil. The cover is utilized to protect the inside mechanism from any shocks which might occur, and also allows it to be used in the open, without damage. It is stated that the magnet can also be employed for lifting very hot pieces of metal, thus making it especially useful in foundries and rolling mills. The current is supplied by two conductors placed along the length of the crane, the connection being made by contact pieces attached to the crab. The electric lifting magnet will be no doubt more extensively used in the future, both in this country and in Europe, as the rapid introduction of electrically-operated machine tools, electric cranes, and other motor-driven machinery insures an abundance of electric current for operating these and any other labor-saving devices, which may be brought out in order to save time and labor in detail operation. Every iron and steel plant, as well as all large machine shops and foundries, are now provided with an electric central power station of greater or less capacity, which not only supplies current for operating motors about the shops and works, but also supplies the necessary lighting service as well.



DOUBLE LIFTING MAGNET AT WORK RAISING TWO I-BEAMS.

Free and Dirigible Balloons.

BY EMILE GUARINI.

Capt. Mathieu, of the Belgian engineer corps, a professor at the military school of Belgium, and a specialist in aeronautics, recently delivered a very interesting lecture upon free and dirigible balloons before the Belgian Society of Engineers and Manufacturers. After a rapid historical review of ballooning, Capt. Mathieu, starting at the epoch at which the physicist Charles made the first ascent in a hydrogen balloon, went on to describe the various types of balloons of the lighter-than-air class, leaving aside the servile imitations of the flight of birds. He showed how the desire to conquer the obstacles opposed by the wind gave rise to the question of the dirigibility of balloons that has cost very many lives, but in our day is making great progress. He also pointed out the inconveniences of the spherical form from the viewpoint of progression, and the incessant attempts made since 1784 to elongate the dirigible types. He referred to the Julien fish-shaped dirigible with clockwork movement, of 1850; the experiments of Giffard, of 1852, and those of 1872. In 1883-4, the Tissandier brothers constructed a dirigible with an electric motor, and in 1884-5 the experiments of Capt. Renard were the talk of the world. The question was taken up again in 1897, and the aluminium type with rigid car was constructed in Germany, while in France were begun the experiments of Santos-Dumont, who has reached his tenth type of balloon. M. Lebaudy, with "Le Jaune," made the most remarkable experiments. Apropos of this, Capt. Mathieu predicted the victory of "Le Jaune" at St. Louis.

As for the future of dirigible balloons, the lecturer gave it as his opinion that these would never furnish an industrial energy sufficient for the carriage of passengers and merchandise; that it would always remain a means of transport for excursions, and especially for military explorations; and that it would never be possible to utilize it as an aerial torpedo machine. As regards spherical balloons, they have yet a long career before them, and are destined to render still greater services than they have in the past.

The lecturer then took his hearers on a couple of imaginary balloon trips, and gave them an idea of the varied impressions that are made upon the passenger in a free ascension.

The old home of Washington at Mount Vernon has been threatened for some time by the encroachment of a stream of water, which if it had been allowed to take its own course, would have undermined the mansion in a few years' time. This disaster has been averted by the action of a patriotic order of women, which has secured the money for the purpose of building a tunnel under the historic mansion, in order to divert the stream. This work is now being performed at a cost of seven thousand dollars, and will soon be completed. This same stream gave the Father of his Country considerable concern, and it is said that just before his death he had decided to move the burial vault on the grounds to a point a considerable distance away from the present location. The task of constructing the tunnel is a very simple one, passing directly under the old homestead. It will be of sufficient dimensions to carry off 50,000 gallons per day.

The largest wine cask ever made is exhibited in the Agricultural Building at the World's Fair. It is 17½ feet in diameter and 17½ feet long, and will hold 14,000 gallons. It is made entirely of oak from Mississippi, Kentucky, and Tennessee. The staves of the cask are five inches thick. Experienced coopers were brought here from Nancy, France, to construct the cask.

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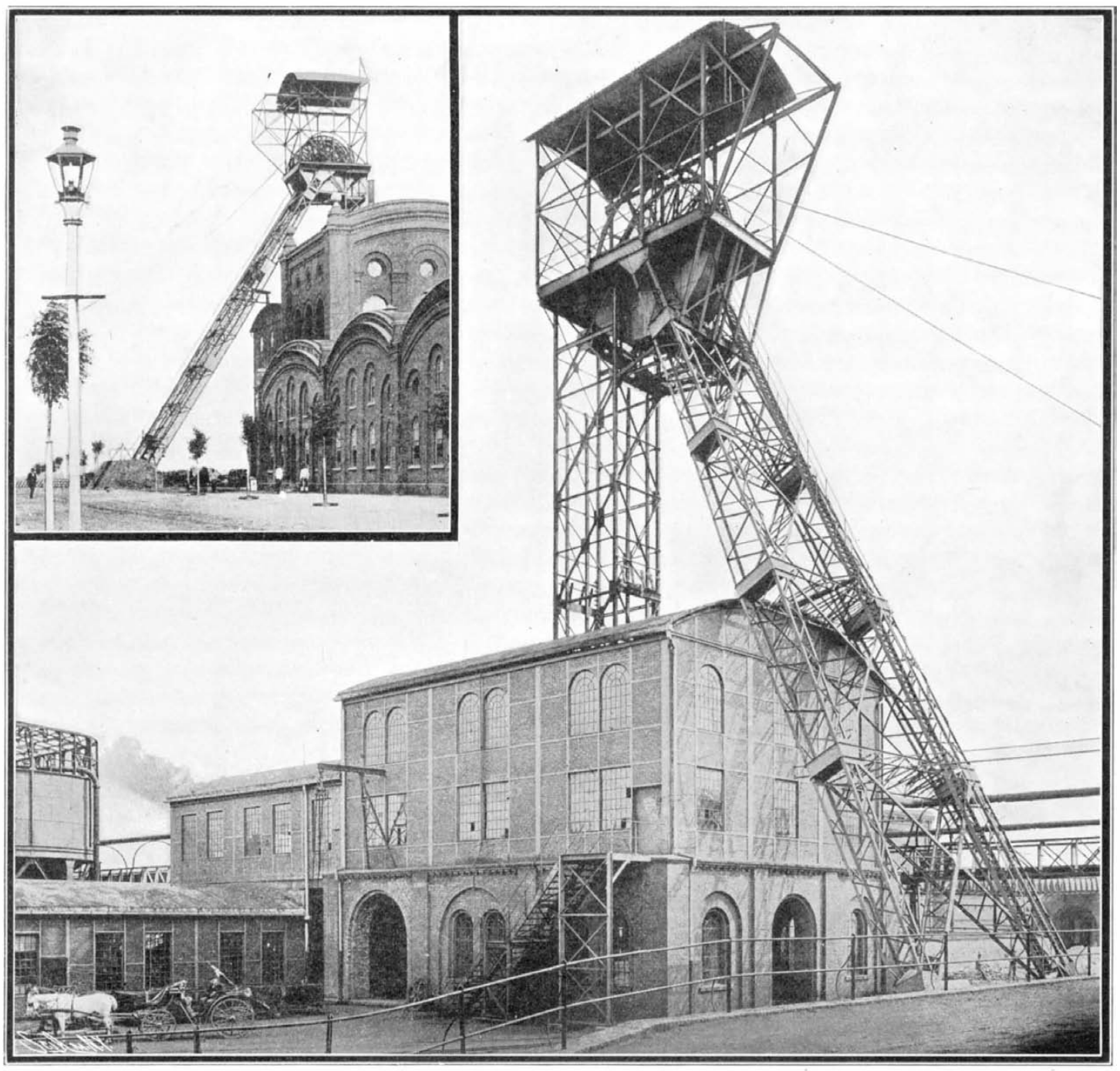
ELECTRICALLY-OPERATED VERSUS STEAM-DRIVEN MINE HOISTS.

Until very recently electric hoists have not been employed extensively for the main shafts of deep mines; but the high efficiency of the electric motor, and the success which has been attained in the design and construction of large electric motors for this work, have increased the number of engineers who favor this system of main shaft mine hoisting.

At the Harpener Bergbau A. G. pit, Scharnhorst II., is installed a twin tandem hauling engine with cone valve motion. The depth of the shaft is 1,968 feet, and the load normally raised is 4 tons, 8 hundredweight. This twin tandem hauling engine has a stroke of 63 inches, and the high-pressure cylinder measures 31 inches in diameter, while the low-pressure cylinder is 47.4 inches in diameter. The drums of this hoisting engine are 19 and 25 feet in diameter.

While heretofore engines of the above character have been exclusively used for this class of mine hoisting, electric installations are now in operation which do the work equally as well, and are favored in preference to the steam hoisting plant, on account of the fact that a large electric central power station can be installed, which will supply current for operating the entire mine as well. Such a power station is installed in the "Gneisenau" mine, and also at the electric station of the "Scharnhorst" mine of the Harpener Bergbau - Actien - Gesellschaft.

These two electric power stations supply current for operating electric mining pumps and electric hoists as well as various mining machinery. It is well understood that if the main hoisting plant was also operated by electric motors of large size, and the entire mine operated by electric power, greater economy would result, on account of the more efficient steam plant which could be installed on a larger scale with units of higher power.



THE SHAFT OF THE RHEINPREUSSEN MINE.

The Gneisenau power station is equipped with a 600-horse-power, horizontal, compound steam engine directly connected to three-phase generators generating a current of 2,400 volts pressure with a frequency of 3,000 alternations per minute, the speed being 100 revolutions per minute. The current is transmitted a distance of 2,460 feet to a double-acting plunger mining pump underground, which raises 176½ cubic feet of water per minute a height of 1,476 feet. The motor is a Helios asynchronous machine operating at 65 revolutions per minute directly from the 2,400-volt power circuit.

The Scharnhorst power station is equipped with two Helios three-phase generators of 300 kilowatts capacity, each operating at a speed of 150 revolutions per minute, and supplying a current of 500 volts pressure. This current is used for operating motors of from 10 to 100 horse-power each, for driving mining pumps and other mining machinery.

Electric hoists have been constructed up to 2,800-horse-power capacity for taking the place of the large steam hauling engines for the main shafts, one of these being described in this journal but a short time ago. This electric hauling engine was directly connected to two direct-current motors of 500 volts pressure built by Siemens & Halske, of Berlin. The diameter of the driving wheel is 6 meters, and a load of 4 tons is raised from a depth of 1,640 feet at a maximum speed of 65.62 feet per second. This wonderful electric hoist was installed at the Zollern II. mine of the Gelsenkirchener Bergwers A. G.

At the Germania I. mine of this same company, there is in operation a Helios polyphase electric hoist which operates at a speed of 9.84 feet per second, raising a load of 3,968 pounds from a depth of 1,312 feet. This machine has a motor of 120-horse-power capacity, which runs at a speed of 485 revolutions per minute, operating the winding drums at a speed of 61 revolutions per minute. This electric motor receives its three-phase current directly from a 2,000-volt power transmission line.

At the Tiederhall mine a Siemens & Halske double electric hoist is operated by two direct-current motors, and carries a load of 1,763 pounds, the speed being 9.84 feet per second. This hoist hauls the material from a depth of 984 feet, and is located at that distance from the surface. Another electric hoist operates a cage in another shaft, going 200 feet deeper into the mine, this hoist also being installed in an underground chamber.

The use of steam engines in place of electric motors would not be considered wise after the experience of mining engineers with modern electric power underground. In a paper before the Federated Institution of Mining Engineers in England some time ago, W. C. Mountain, speaking on the subject of "Electric Motors for Transmission of Power in Mines," said:

"Mining engineers are probably not generally acquainted with the loss that occurs in steam-pipes in mines. Mr. Hy. Davey carried out tests on a main steam pipe 1,100 feet long, 7½ inches in diameter, and 1 inch thick. The main was used for conveying steam at a pressure of 45 pounds per square inch to an underground pumping engine at the Morton pit of the Clay Cross collieries. The pipes were covered with non-conducting composition. As a result of careful experiments, it was found that the condensation of steam in the main amounted to 500 pounds of water per hour when the engine was standing, and 750 pounds of water per hour when the engine was working, equivalent to 0.183 and 0.274 pound per square foot of surface of pipe per hour respectively."

He further stated that—

"At the Staveley Hill Collieries, Mr. W. Worby Beaumont carried out experiments which showed that with a length of 2,300 feet of pipe, 1,900 feet of which was underground, and covered in some instances to a depth of two feet with rough stuff left after cutting away the coal, the condensation in pipe 6½ inches in diameter and 1⅛ inches thick, conveying steam at 34 pounds per square inch, was 600 pounds of water per hour with the engine standing and 400 pounds per hour with the engine working. This condensation is equivalent to a condensation of 0.113 and 0.265 pound of water per square foot of surface of pipe per hour. For uncovered pipes, of which unfortunately there are very many in mines, it may be safely assumed that the condensation is not less than 1 pound of water per superficial foot of pipe exposed. If the pipe at the Staveley Hill colliery be taken as a fair example of underground work, a simple calculation shows that, assuming we evaporate 6 pounds of water per pound of coal, it is necessary to burn 233 pounds of coal per hour in order to make up for the loss due to condensation."

There is no question but what mining engineers at the present time realize that the losses in steam pipes operating pumps, ventilators, hoists, and other mining machinery by simple engines of small capacity, as well as the low efficiency of these engines, make it desirable to utilize electric power wherever possible. The mines may then be lighted as well as supplied with the necessary power from the same conductors.

Numerous examples of electric hoisting plants in American mines could be given, showing the extended use of this class of electric machinery.

A new world's record for the conveyance of mails was established recently by the Great Western Railroad of Great Britain. The mails from the North German Lloyd steamship "Kronprinz Wilhelm" were landed at Plymouth and embarked upon the first section of the waiting train. The first train left the port with 1,085 bags at 9.23 A. M. and arrived at Bristol at 11.27, where the North of England mails were dropped. A fresh engine was attached to the train, which left Bristol at 11.30 A. M. and arrived at Paddington, the London terminus, at 1.10. The whole journey from Plymouth to London, a distance of 246 miles, was thus covered in 3 hours 47 minutes, including the stop at Bristol. The train thus maintained an average speed throughout the whole journey of over 65.02 miles per hour. The last 118 miles from Bristol to London were covered exactly in 100 minutes, which is equivalent to 70.8 miles per hour.

During the year 1903, the German navy was augmented by the construction of ten warships representing an aggregate displacement of 59,477 tons. This is an increase in the tonnage over the previous year of 29,082 tons. Of this total launched, there were three armorclads aggregating 39,600 tons; one armored cruiser of 9,500 tons; three small cruisers of 9,000 tons; and a gunboat of 977 tons.

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THE JAPANESE NAVAL DISASTERS.

On March 5 we published a view of the Russian ships which had suffered disablement, or been totally lost, at that period of the Russo-Japanese war. It had been a matter of frequent comment during the course of the war, that in spite of the activity with which the Japanese are prosecuting their offensive operations, extending over a period of several months, they should have suffered the loss of not a single ship. This period of immunity could not last indefinitely, and two or three weeks ago, while one of the torpedo-boat divisions was engaged in the hazardous work of clearing the entrance to Kerr Bay of submarine mines, a torpedo boat was struck by one and was destroyed. Curious to relate, not many hours passed before a torpedo gunboat, the "Miyako," suffered a like fate. Then a few days later occurred what was without exaggeration, for Japan, an appalling disaster, when the "Kasuga," one of the two armored cruisers recently purchased from Chile, rammed and sank the fast protected cruiser "Yoshino," and the great battleship "Hatsuse" struck one of the floating mines, with which the Russians are supposed to have liberally sown the waters around the Liao-tung, and went to the bottom with a loss of more than half her crew of 750 men. Then following close upon this dual disaster came the destruction of the torpedo-boat destroyer "Akatsuki," with the loss of one officer and twenty-four men, during a reconnoissance off Port Arthur.

Now, the magnitude of this loss is not to be estimated by a mere statement of the total displacement that must now be stricken off from the list of protected ships. A total of 21,470 tons is, of course, a big deduction to make from the total of 238,000 tons of the Japanese effective navy; for it means a reduction of nine per cent. If, however, we take note of the character of the ships that were lost, it is not too much to say that the strength of the Japanese navy has been reduced fully fifteen per cent by this loss; for of the 21,470 tons, 15,000 tons represented battleship displacement, and for its actual fighting value, a ton of battleship displacement is worth at least a ton and a half of armored cruiser displacement, and from two to three tons of protected cruiser or gunboat displacement. By the loss of the "Hatsuse," the strength of the first line of battle of Japan has been cut down seventeen per cent, and this is a loss that can never be replaced while the war lasts. The loss of the swift protected cruiser "Yoshino" will be felt when it comes to a question of scouting, or the convoying of transports should the Vladivostock fleet venture out, or the Baltic fleet be dispatched to the Far East. The same may be said of the torpedo gunboat "Miyako," of 1,800 tons, whose speed of 20 knots rendered her valuable for scouting purposes.

The torpedo-boat destroyer "Akatsuki," disabled at Port Arthur, was one of the finest in the Japanese fleet, being a Yarrow boat of 385 tons displacement, 6,000 horse-power, 31 knots speed, and a complement of 55 officers and men. She carried two 18-inch torpedo tubes, and mounted one 3-inch 12-pounder and five 6-pounders.

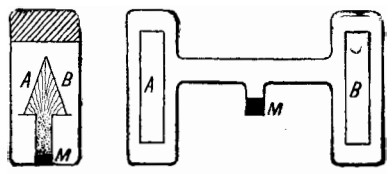
The torpedo boat lost in Kerr Bay was spoken of in the dispatches as No. 48. She was probably a first-class torpedo boat of about 130 tons displacement and 27 knots speed; but as the Japanese have thirty-eight first-class torpedo boats, her loss will not be so seriously felt as will the loss of the "Akatsuki," which was one of the best of the twenty destroyers owned by Japan.

The "Yoshino" was the earliest to be commissioned of the fleet of four very fast protected cruisers of from 4,150 to 4,760 tons displacement owned by the Japanese. She was built at Elswick in 1892; the other three vessels being the "Takasago," built by the same firm in 1897, the "Chitose," built at San Francisco in 1898, and the "Kasagi," built at Cramps in 1897. The fastest of this quartet is the "Takasago," which made 24 knots on trial, and the slowest of them the "Kasagi," which showed a speed of 22.6 knots. The "Yoshino," which was of 4,150 tons displacement, was protected by a steel deck 4½ inches thick on the slopes, and carried four 6-inch and eight 4.7-inch rapid-fire guns, and twenty-two 3-pounders. She had five above-water torpedo tubes, two on each broadside and one in the bow. Her maximum coal supply was 1,000 tons, and her twin-screw engines drove her, on trial, at a speed of 23.08 knots per hour. The "Miyako," destroyed in Kerr Bay, was a torpedo gunboat of 1,800 tons displacement, and a complement of 220 officers and men, that was built by the Japanese in 1897. She carried two 4.7-inch rapid-fire guns, one forward and one aft, behind shields, and eight 3-pounders on the broadside. She was driven by two triple-expansion engines of 6,130 horse-power at a speed of 20 knots. She was entirely unprotected as to her hull.

Next to the "Mikasa," the "Hatsuse" was the finest battleship in the Japanese navy, her displacement being 15,000 tons, and her complement of officers and men 741. She carried four 12-inch, fourteen 6-inch, and twenty 3-inch guns, besides eight 3-pounders and six 2½-pounders. She had four submerged torpedo tubes, two on each broadside. Her hull protection consisted of a continuous belt, 9 inches amidships, 4 inches at the ends, of Harvey nickel-steel. The deck was 4 inches on the slopes, and the side of the ship, amidships, in the wake of the batteries, was protected by 6 inches of armor to the level of the lower deck, while the 6-inch guns were protected by 6-inch casemate armor. She had a maximum coal supply of 1,500 tons, and on her trials her engines indicated 16,117 horse-power and drove her at the speed of 19.11 knots an hour.

NEW FORM OF RADIATION.

M. Debierne, in a paper read before the Academie des Sciences, brings out some new phenomena in connection with radio-active bodies. Previous experiments show that the induced radio-activity caused by radium and actinium is produced by particular centers of energy (active ions or a form of emanation from the substance), and these centers are given off continuously by the active body and form an atmosphere around it. It has been shown that two parallel plates which are placed in this atmosphere become active, the activity becoming greater as the distance which separates them increases. The effect is thus stronger as the number of ions included between the plates is greater. It may be concluded that the active centers do not act



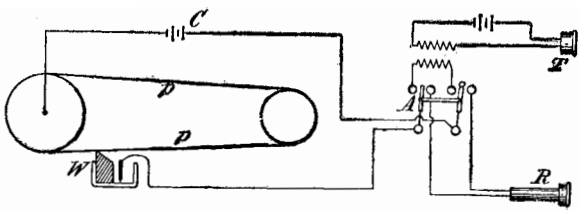
NEW FORM OF RADIATION.

by direct contact with the plates. The phenomenon takes place as if the effect were produced by a special kind of radiation emitted by each of the centers, and that the induced activity of the plate is proportioned to the total radiated flux which it absorbs. The author showed previously that the active ions given off by actinium were concentrated in the neighborhood of the source. If a compound of actinium be placed at the bottom of a tube at *M*, the active ions are almost all confined within the tube, but two plates, *A* and *B*, placed before the opening are nevertheless affected somewhat strongly, due to the radiation from each of the ions.

If the apparatus is placed in a magnetic field perpendicularly to the plane of the figure, one of the plates is more strongly affected, while the other becomes weaker in the same degree. The radiation from the ions thus seems to have been deflected by the field. This deflection occurs in the inverse sense from that of the cathode rays. The active ions are but slowly diffused. It is not probable that the magnetic field acts directly upon the ions, but that it is their radiation which is deflected. The following experiment shows that the diffusion of the ions is not appreciably changed by the magnetic field. The compound of actinium is placed at *M* in communication with two chambers, each containing a plate, *A* and *B*. The pressure in the apparatus is lowered so that the diffusion of the ions takes place easily. The plates are thus strongly affected and both to the same degree. When the central part is placed in the magnetic field, leaving the plates outside, nothing is changed. The field therefore does not act upon the ions, but upon the radiation which proceeds from them. These experiments show that there exists a new form of radiation which is characterized by the property it possesses of rendering radio-active for a time the bodies which it strikes. This radiation is emitted by the active centers which are distributed in the neighborhood of the actinium. The new rays have the property of being deflected by the magnetic field.

ELECTROCHEMICAL PHONOGRAPH.

An electrochemical phonograph has been devised independently by Messrs. Nernst and Lieben. Instead of using magnetic action on a continuous band, as in the Poulsen phonograph, the inventors use electro-



AN ELECTROCHEMICAL PHONOGRAPH.

chemical action. As will be seen in the diagram, a platinum band, *p*, passes over two pulleys which are operated by a motor. Against the band presses a wedge of wood, *W*, partly immersed in an electrolyte contained in the glass vessel. Near it is an electrode which is connected to one of the contact points of the switch, *A*. At *T* is a telephone transmitter which may be connected in the circuit through a battery and an induction coil, and at *R* a receiver which may be thrown in. To produce the record the transmitter is connected in; then the band is passed again, and the reproduction may be heard in the receiver. A supplementary battery, *C*, is also used. Under the influence of the telephone currents an electrolytic action is produced, and the platinum band becomes polarized successively, the action being analogous to the magnetic band of the Poulsen phonograph. Upon passing the band a second time and connecting the receiver, the reproduction is heard, and its sharpness and durability depend on the kind of electrolyte used. But it is remarkable that for reproducing the record an additional electromotive force is necessary in the telephone circuit, supplied by the battery, *C*, and that within certain limits the audition is better as the battery is stronger. This phenomenon is difficult to explain, as it would be supposed that the currents are produced by the discharge of the polarized electrode, and in this case the addition of a constant electromotive force should have no action, since it is only the variation of current which produces the effect. It may also be explained by a simple variation of resistance in the circuit, but it is difficult to suppose that such a variation in resistance could be caused by the polarization of oxygen or hydrogen on the platinum. Besides, M. Lieben has found that the same effect is produced when the resistance is not varied, in the case of a silver band and a solution of double cyanide of silver and potassium. He has made a number of researches with different forms of the apparatus, and concludes that the phenomenon cannot be explained by polarization alone. On the other hand, the idea of a resistance variation will not account for all the effects. A third hypothesis is based on the variation of the friction of polarized electrodes observed by Edison. To efface the record a compress wet with acid is pressed against the band. It is still better to connect it with a pole of the battery, when a continuous electrolytic action is produced which acts like a brush to efface the record.

Spread of Cotton-boll Weevil.

The invasion of the cotton-boll weevil has been a special menace to the cotton crop and has awakened widespread apprehension as to the future of this crop. In addition to the excellent work of the Division of Entomology in combating this pest, the Bureau of Plant Industry has during the past year done considerable work with a view to securing, if possible, early and resistant varieties by breeding and selection. Notwithstanding all that has been accomplished, however, the boll-weevil is constantly spreading north and east, and it seems but a question of time when it will reach all the cotton-growing States. The country is thus confronted with a very great problem, as the invasion of this insect necessarily means a complete revolution in present methods. The Secretary reports that after a personal visit to the South and a thorough canvass of the situation with representative men in Congress and with others, he is of opinion that a cotton-investigation fund should be appropriated for immediate use in connection with this problem. He believes that not less than $500,000 should be appropriated and made immediately available to make this work comprehensive and thoroughly effective, and he enumerates in detail ten problems to the solution of which these funds should be devoted. Should this recommendation be carried out, his plan of work would be to utilize and combine the efforts of the Bureau of Plant Industry and the Division of Entomology, for which he recommends reorganization as a bureau, with the addition of the advice and co-operation of one or two thoroughly practical men in the two States most interested, namely, Louisiana and Texas. The Secretary of Agriculture, he adds, should have full authority to organize the work for the sole object of securing the most immediate practical results.

Gold and Other Minerals in Corea.

The mineral wealth of Corea is considerable, and at present there are a number of gold, silver, iron, and coal mines in operation; petroleum is also obtained from a number of wells. As to the production of gold in Corea, the following figures show the output from 1898 to 1902, and it will be observed that it has more than doubled in that time:

1898	$1,200,040
1899	1,666,670
1900	1,816,100
1901	2,558,700
1902	2,585,200

The greater part of the gold which is produced in Corea is sent to Japan. Iron ore and coal deposits are abundant, but as yet these have been but little worked. Copper is taken out in several districts, and in the last two years the production of copper reached 280 tons, valued at $52,400. The mineral deposits of Corea belong to the crown and persons wishing to operate them are obliged to secure a special authorization. As the government is not favorable to foreigners, this becomes especially difficult, and considerable trouble is experienced before foreign companies can secure concessions in this country.

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Correspondence.

Battleship Plans.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read with much interest your last copy of the SCIENTIFIC AMERICAN, containing the Naval Supplement. To me this is usually the most interesting part of your paper, viz., the illustrating of our navy.

It would be still more interesting if you could show the large battleships, etc., in elevation, giving also a plan, and showing these on as large a plan as you could, say a page or half a page.

Why could you not try this in illustrating some of the later ships authorized? H. D. HANALE.

Boston, Mass., May 13, 1904.

[We hope to deal with the subject along these lines in an early issue.—ED.]

The Home-Made Wind Vane.

To the Editor of the SCIENTIFIC AMERICAN:

I beg to invite your attention to an erroneous statement made by Mr. H. W. Harmon in his article on "Electrically-Registering Wind Vane and Anemometer for School Use," in the SCIENTIFIC AMERICAN SUPPLEMENT of May 14, where he says that "the United States Weather Bureau instruments . . . record only once in ten minutes." The facts are that the automatic wind-registering instruments employed by this bureau for over twenty years past make continuous record of the actual wind movement by miles, whether this velocity is barely appreciable or up to and including winds of hurricane force, viz., over one hundred miles per hour; the wind direction being simultaneously recorded on the same sheet for each minute, and to the eight principal points of the compass.

Mr. Harmon has, however, displayed considerable ingenuity in the design of his "home-made" apparatus.

WILLIS L. MOORE,
Chief U. S. Weather Bureau.

Washington, D. C.

A Japanese Physician's Antidote for Snake Bite.

At a recent banquet of the Association of American Physicians, Dr. S. Weir Mitchell made the announcement that Dr. Noguchi, a well-known Japanese physician at present on the staff of the Serum Institution in Copenhagen, has discovered a positive antidote for rattlesnake venom. Dr. Noguchi's researches were carried on under a grant from the Carnegie Institution.

The fact that the announcement of the discovery was made by Dr. Mitchell is of particular interest, as more than forty years ago the latter worked long and unsuccessfully on the problem that has been solved by Dr. Noguchi.

The letter to Dr. Mitchell from the Japanese physician did not contain a great many details, but said that the serum had been obtained from the blood of goats and could probably be secured as well from horses as in the case of serums in use at present.

Dr. Noguchi found that guinea pigs that had received injections of rattlesnake poison up to twelve times the amount necessary to produce death and had then received injections of the anticrotalic serum experienced no evil effects from the poison.

The Current Supplement.

"The Elizabeth Suspension Bridge at Buda-Pest" is the title of an article that opens the current SUPPLEMENT, No. 1483. The bridge is a noteworthy engineering structure, inasmuch as it employs a form of eye-bar that has been made the subject of considerable acrimonious discussion in the technical press of this country. At a recent meeting of the Manchester Geological Society, Mr. Alfred J. Tonge read a paper on "Coal Cutting by Electricity," in which he gave useful and very interesting details respecting the results obtained by the introduction of electrically-driven coal cutters at the Hulton collieries near Manchester. The paper is abstracted in the current SUPPLEMENT. Nikola Tesla discusses the transmission of electric energy without wires. "Curious Optical Illusions" is the title of an article that gives many a bit of singular information. Mr. Percy Collins writes instructively on the protective resemblance of insects. His article is elaborately illustrated. The life of a forest is discussed by Mr. Gifford Pinchot. The compressed-air power plant at the St. Louis Exposition is made the subject of an exhaustive discussion.

The Death of William Wallace.

William Wallace, one of America's most distinguished electrical inventors, died on May 21 at the ripe old age of eighty. His career was long, honorable, and varied. An Englishman by birth, Mr. Wallace emigrated to this country with his father, established himself at Ansonia, Conn., and founded the firm of Wallace & Sons, widely known as one of the leading makers of copper and brass alloys in the United States.

Mr. Wallace's electrical work was done partly in collaboration with Prof. Moses G. Farmer. The two began the manufacture of a compound telegraph wire, which consisted of a steel core upon which a copper covering was electrolytically deposited. The result was a wire of remarkable conductivity, strength, and lightness. At the Centennial Exposition of 1876, Mr. Wallace exhibited the Farmer-Wallace dynamo machine, by means of which the buildings were lighted. This is probably the earliest instance of electric lighting on a large scale in this country.

Not long after the close of the Philadelphia Exposition, Mr. Wallace introduced a plate arc lamp to be used in connection with his dynamo, the object being to place a number of arc lights in series circuit. In this manner originated the series method of arc lighting, which is now so generally employed.

Mr. Wallace's interest in the scientific questions of the day was such that he established in his home a laboratory, where he performed many an interesting experiment, and threw not a little light upon unsolved electrical problems. One of his electrical feats was the construction of an induction coil which at the time was of unprecedented size.

A Simple System of Photographic Exposures and Plate Speed Markings.

BY FRANK MORRIS STEADMAN.

In photographing any certain surface in nature, other things being equal, neither the size of that surface nor its distance from the camera alters in any degree the length of the exposure, or in other words, the intensity of the cone of light which impinges on the emulsion. This being true, it may be said that the intrinsic intensity of a surface, together with the value of the diaphragm employed, creates the intrinsic light intensity impinging upon the sensitized film.

If then the light which creates the intrinsic intensity at the brightest part of any subject that is to be photographed be made to do a certain fixed amount of work, the length of time required will fully account for the condition of that intensity and will annihilate at a stroke the necessity of considering all those factors of intensity that have clung to all the exposure tables, as the latitude from the equator, the season of the year, the hour of the day, etc.

But it still further accounts for and fully explains the very early and late hours of the day which the tables cannot fix, as well as the local conditions of the weather which are also impossible to control in tables.

In interior home portraiture also, by the common window, the light will be doubled by the movement of the subject a few feet nearer to the window or by letting down the top sash of the window. These are things that tables cannot fully cover and it would be childish to try to explain them by tables when a strip of Solio in a few seconds will give an exact (practically) numerical expression of the intensity in any possible complex condition of all these factors.

This fixed amount of work is the tinting of Solio paper to a just plainly visible tint when seen in contrast with the original color of the untinted Solio.

The tint is made at the position of the brightest part of the subject. To make it a strip of the Solio is placed behind the thin opaque cover of an ordinary pocket note book in which there is cut a small hole about a quarter of an inch square. The Solio strip is slipped in place under the hole and the latter covered with a coin, and when the book is placed in position and turned exactly facing the brightest source of light the coin is slipped off and the time counted until it is thought that a tint is secured. The time given should be one of the following scale of intervals (this may be adhered to in practice by reason of the great latitude of the photographic emulsions): 1/8, 1/4, 1/2, 1, 2, 4, 8, 16, 32, etc., seconds.

Find the one interval that creates the first just plainly visible tint. That length of time will be the "Solio time" of that particular intensity where the Solio was held.

This Solio time is taken as a convenient basic exposure and the whole problem resolves itself into the following: When using the Solio time of the light as the exposure, what diaphragm with any certain emulsion and a certain class of subject, will create the normal effect in the sensitive emulsion?

This diaphragm once found is a fixed element for that plate or film and that same subject and it is called the "Solio diaphragm" of that subject for that plate or film.

With the Eastman film which I use in my private work, and with a subject of normal complexion, I find this Solio diaphragm to be number 16 and for a very light complexion, number 32, U. S.

If the subject be an ordinary exterior with average-colored objects in the middle distance the diaphragm which gives the correct effect in the emulsion with the Solio time as the exposure is number 64.

The following table divides conveniently the different subjects liable to be encountered in nature and the Solio diaphragm of each subject is seen after each. In using the system the Solio time of the light is the exposure with the Solio diaphragm mentioned after the particular subject that is being photographed.

This subject table with the Solio diaphragms follows (for Eastman film and emulsions of like speed):

	Diaphragms. U. S.	f.
Portraits:		
Very light complexion	32	22
Average complexion	16	16
Very dark complexion	8	11
Room Interiors:		
White walls	64	32
Average walls	32	22
Very dark walls	16	16
Dark machinery.	8	11
Regular Exteriors:		
Bird's eye class	128	45
White objects in middle distance	128	45
Average objects in middle distance	64	32
White objects in foreground	64	32
Average objects in foreground	32	22
Green trees abounding	32	22
Marines and Snow Views:		
Bird's eye class	256	64
Objects in middle distance	128	45
Objects in foreground	64	32
Buildings:		
White	128	45
Average color	64	32
Very dark as red brick, etc.	32	22

U. S. is the universal system of marking diaphragms. f is the equivalent focus system. The figures represent the fractional part of the equivalent focus of the lens.

Example: On photographing a regular exterior with average colored objects in the middle distance, the Solio time is found to be one-half second in the full light. On looking at the table, the "Solio diaphragm" of that subject is seen to be U. S. 64. Therefore, one-half second is the correct exposure with that diaphragm. If it is desired to use any other diaphragm, it remains necessary only to halve that exposure for each whole number that the diaphragm is opened, or double it for each number that it is closed beyond the one mentioned in the table.

If some other emulsion was found to be slower than Eastman film, the table could be corrected by placing a correspondingly larger diaphragm number opposite each subject, so that the exposure would still be normal while giving the Solio time. If another emulsion was faster, the diaphragms would be enough smaller to still retain the Solio time of the light as the correct exposure.

This system should be applied in practice as follows: The worker should become expert in the counting of time in exact seconds, and the fractions one-fourth and one-half of a second, and also in the act of taking the Solio time in any light. This only requires a little care to not turn the Solio toward the direct light until it is protected, and then holding at exactly right angles to the light source and giving the exposure with exactness, guessing the first time at the factor 1, 2, 4, 8, etc., that will create the standard or just plainly observable tint when the corner of the note-book is raised to look at it, and then give more or less exposure as may be necessary to obtain the correct tint.

Then the manufacturers of plates and films should place this subject table in each box of their products, corrected as to the diaphragms that follow the subjects, so that the one found opposite any subject will give the normal effect with the Solio time of the light as the exposure.

They should correct the table for each speed of emulsion that they make. By this method any box of plates could be used in any part of the world, and although the maker's name and the rapidity of the emulsion was unknown, the user could obtain normal results with the first plate exposed as well as if they had been constantly in use for months, regardless of the kind of subject to which the worker was accustomed.

The shutter manufacturers have their part to do in adjusting the automatic speeds given by their instruments to the same scale as the Solio intervals of time, as 1, 1-2, 1-4, etc., second.

The system can be substituted for exposure meters, and the expense is merely nominal, as the few strips of Solio paper that are used in taking the measurements are practically without value.

An ordinary notebook with a small hole cut in the cover is all the provision that the worker need make to prepare him to use the method.

If to understand how to use plates and films will tend to increase their use and to lessen the troubles of the users, then certainly the advantages of instituting the system will be shared alike by both makers and users.

Those who practice photography should be expert at the counting of time in seconds. To count any desired number of seconds say: "Naught-one-half-and-one, one-half-and-two, one-half-and-three, etc." For one second, say the first line only; for a half second say, "Naught-one-half," and for a quarter second say the word "quar-ter" at talking speed.

Practice the lingo with the second hand of a watch or count with a clock that ticks in quarter seconds.

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THE MANUFACTURE OF STRAW HATS.

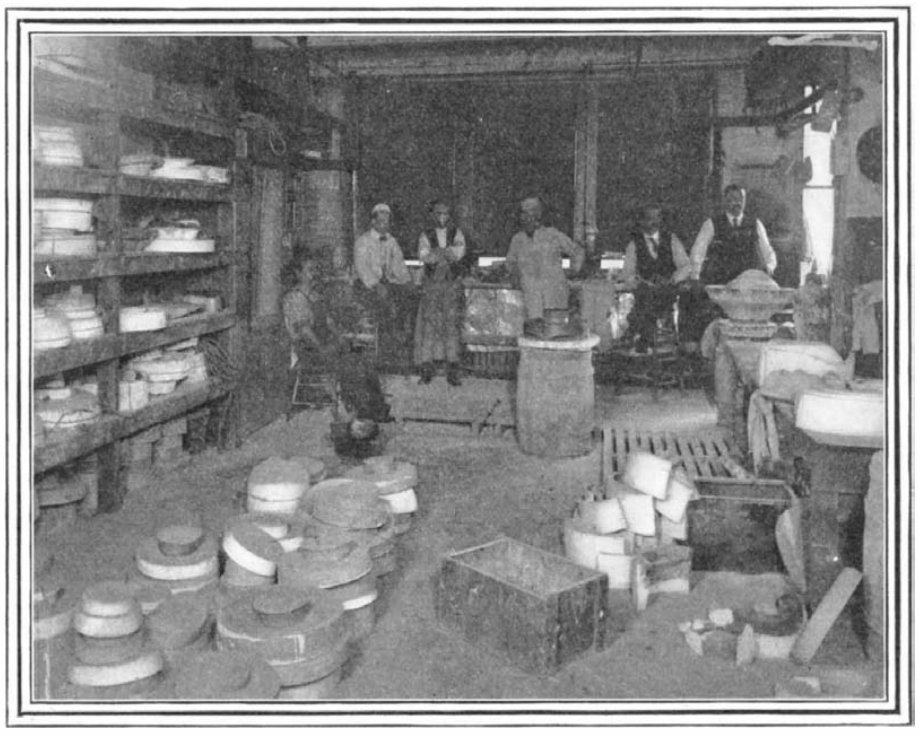
BY W. FRANK M'CLURE.

The first step in the making of modern woman's headgear is the importing of the braided or plaited straw or chip, principally from Japan, and the styles from Paris. The felt for fall and winter hats is bought of American manufacturers. When the styles have been decided upon, the molders in the basements of the hat factories begin the fashioning of quantities of plaster of Paris and metal into blocks and dies of many shapes. With the blocks made and the straw or felt on hand, the operations, among which are blocking, sewing, stiffening, and pressing, follow with the assistance of hydraulic presses and other machinery.

The factory stock room is an interesting place. For spring hats, the manufacture of which is begun in the fall, more than one hundred different styles of braid are used, all of which comes to the factory in its natural color. The larger factories do a great deal of importing themselves, while on the other hand a large per cent of these straws are brought here by the big importers of New York. Aside from Japan, braids are imported from Italy, Germany, France, and Switzerland, but it is to Japan belongs the credit for the greatest progress in the making of a fine quality of clean and light-weight braids. These braids come in pieces sixty yards in length, each such piece weighing not more than a quarter-pound. Where the style of braid is a particularly desirable one, a manufacturer will often order as high as ten thousand pieces of the one kind at a time.

The chip which is used is taken from the trees of Japan. The straw from that country is of a much whiter color than would be possible to obtain in this country. The moist atmosphere of Japan is conducive to the desired shades of the straw. The difference in fine and coarse straw is the difference between the straw at the roots of the growing stalks of grain and that at the top. In Italy many peasants raise wheat, not for the food crop, but for the making of hats solely. There, to improve its quality, it is sometimes cut before the grain is ripe. The straws are carefully cut so that the tops, the bottom portions, and the centers may be kept in separate piles, thus determining the different grades of the finished product.

Before proceeding to the methods of American hat manufacture, it may be stated that in England a large portion of the hats from braid are made in the homes, and that in Paris the hat manufactory buildings scarcely compare in size with those of the United States. In England many people are employed making hats in their homes, after obtaining the braids from the wholesale houses, and when their work is completed, it goes back again to the hat dealers.



Making the Blocks.

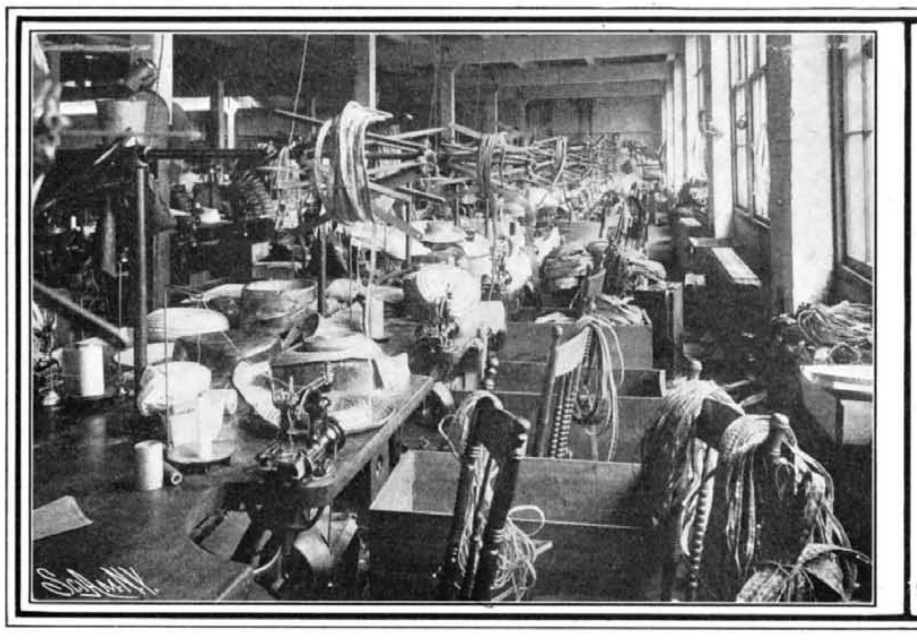
In the factory where the accompanying photographs were made there are 75,000 square feet of floor. The methods and operations employed here are typical of modern American hat-making in general. Two hundred women are employed in the sewing department alone, which number is a little less than half the total number of employes in the factory.

With reference first to the making of hats from straw and chip braids, these braids, prior to being placed in the stock room, are dyed numerous colors. From the stock room they go to the sewing department, which represents a large and important department of every factory. There are some two hundred sewing machines in one large room, though much of the finer work is done by hand. The plan for shaping the straw as sewed is obtained from the blocks made in the molding department.

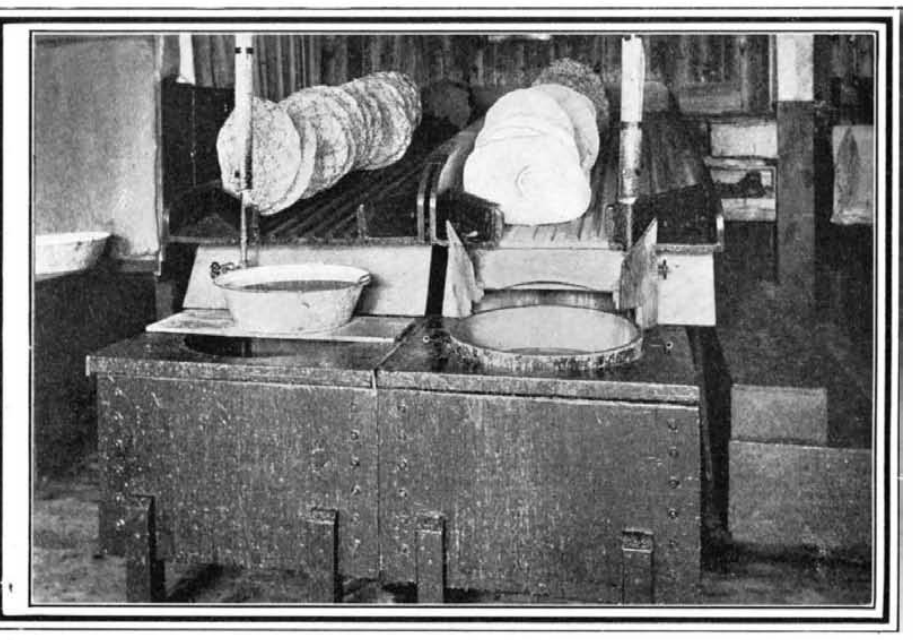
The blocks upon which the hats are shaped in the sewing room, as before stated, are made of plaster of Paris, which is brought in dray loads to the factory each month. The patterns for these blocks are first cut in wood. The metal dies are made of zinc spelter, and each die when completed has an average weight of 110 pounds. Tons of zinc spelter are thus used. The metal dies are used in the blocking and pressing departments of the factory.

In the sizing room the hats are stiffened by means of glue, after which they dry before going to the blocking room. The blocks upon which they are placed are heated by steam. In the pressing room of the factory there are twelve hydraulic presses and twenty-six steam presses. The former are used for hats requiring a smooth finish, and the steam machines are used where rough effects are desired. Under the hydraulic presses straw hats are subjected to a pressure of 75 to 100 pounds. The pressure upon a felt hat is often as high as 500 pounds. These machines stiffen the hats and give them a high polish. Straw hats on coming from the presses are given a coat of varnish, and after being wired are ready for the trimmers.

Felt comes to the hat manufacturers in the form of

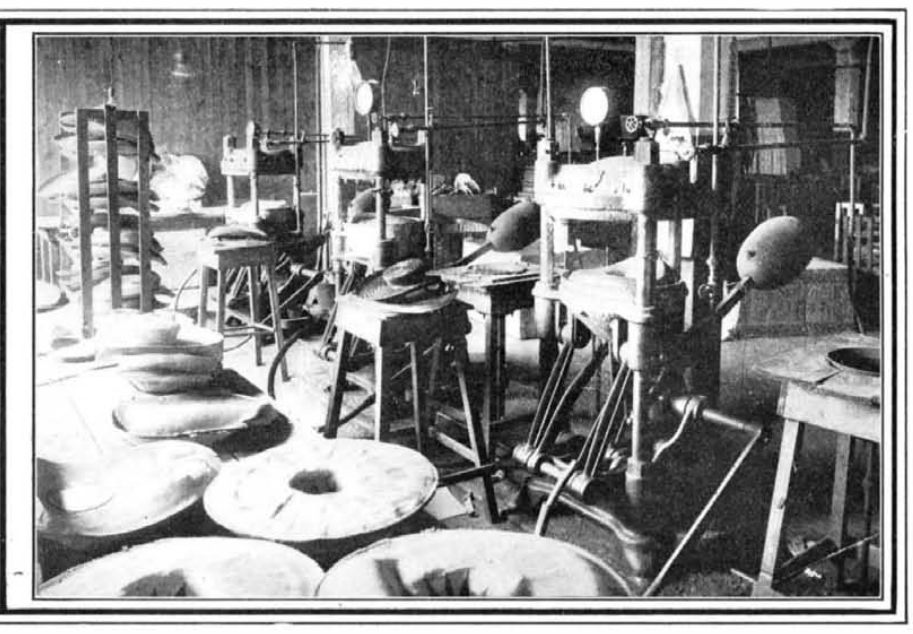


The Sewing Machines.



The Stiffening Room

Blocking the Hats.



The Press Room.

THE MANUFACTURE OF STRAW HATS.

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rolls, which can be cut into sheets, or else it comes in the shape of cones. When in sheets, a first operation is to cut the felt in accordance with the sizes of the hats as dictated by the styles. Next the felt is stiffened, but, instead of simply glue being used, the preparation is part glue and part shellac. The felt hat is given its shape by means of heated dies and mechanical presses. When it comes from these it looks like a hat, save that the edges are often irregular. These edges are trimmed off, and the hat is combed and pounced. The comb is used so that the nap of the goods will run in one direction. The pouncing is done with a kind of sandpaper. The hat is then wired and bound and finally placed in the hydraulic presses, as in the case of the straw hat.

The output of a large factory is from four hundred to five hundred hats per day. While large quantities of untrimmed hats are sent to the markets of the United States, and subsequently furnish employment to thousands of milliners, still there are factories which have trimming departments of their own, and which send out the finished product in the shape that it is to be worn by the purchaser.

The hat-making industry, like the majority of American industries of the present day, is growing noticeably in size with the increase of population. Within the past two or three years a number of the leading hat factories of the country have increased the size of their establishments, thus admitting of a larger output. Though the busiest portions of the year aggregate about eight months, nowadays there is activity at the hat factories the year round. With the spring hats all on the market, the making of fall and winter hats for 1904 and 1905 will begin as early as the first of July next. New styles will then, of course, require new molds and new dies. The old plaster of Paris molds are considered useless, and are thrown on a scrap pile.

THE PETROLEUM RESERVOIRS OF CALIFORNIA.

BY H. A. CRAFTS.

During the year 1903 California's product of crude oil amounted to 25,000,000 barrels. Of this amount the Kern River fields, four miles from Bakersfield, produced 16,000,000 barrels, or nearly 66 2-3 per cent of all the oil produced in the State. And this in spite of the fact that the Kern River fields cover a territory hardly more than five miles square, and of the additional fact that the fields have been in operation but little more than four years. Even as early as 1901 Kern County shipped 52.7 per cent of all the oil produced in the State, and this with only 233 wells in operation.

Now there are 876 active wells in the Kern River fields, and the daily product of the individual wells ranges from thirty to four hundred barrels. The average product to the well is said to be one hundred barrels daily. But this is probably in excess of the actual product, for at that rate the total product for the year 1904 would be over thirty-two million barrels, or twice the total output for the year 1903.

In spite of the fact that the daily shipments of oil from Bakersfield are 60,000 barrels, while the home consumption is large, there are immense quantities of petroleum accumulating at the fields. The Standard Oil Company, which has established itself there as a buyer, refiner, and shipper, has not less than six million barrels in storage; to say nothing of the oil held in reserve by the various operating companies.

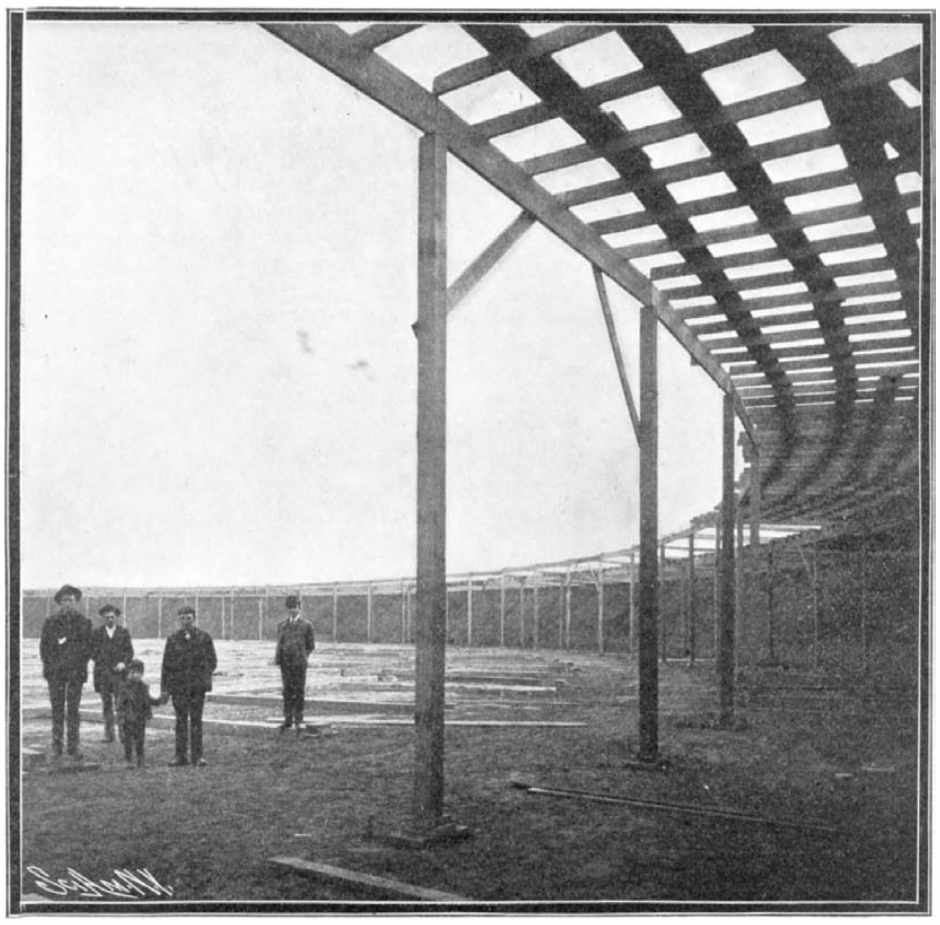
Consequently, the ingenuity of the oil people has been greatly exercised to secure adequate facilities for storing the surplus product of oil. Naturally, the Standard Oil Company is the larger storer of oil. It began by erecting the regulation tubular steel tank, but gave up the idea when it came to realize the actual producing capacity of the fields. Then it began constructing the earthen storage reservoir, which means but little more than a hole in the ground. The size of these reservoirs increased as the prodigious product of the wells was contemplated by the builders.

The larger of the storage reservoirs constructed and operated by the Standard Oil Company has a total capacity of 500,000 barrels. These reservoirs are circular in form, and their diameters vary from 400 to 500 feet, and their depth from 14 to 16 feet. The first of the reservoirs to be constructed were cemented, over their beds, to prevent the oil from seeping. But even that expedient is considered too expensive now, and the earth composing the beds is now merely tamped well before the oil is turned in.

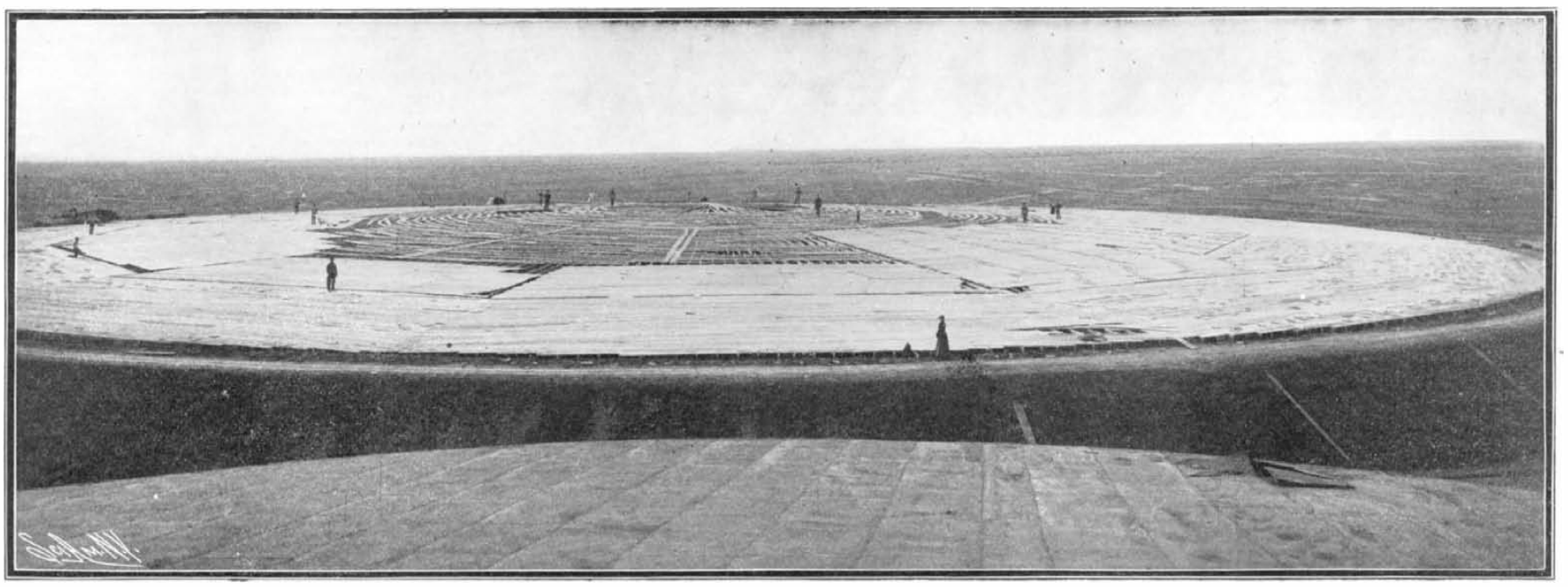
The reservoirs as soon as excavated and tamped are roofed over with inch boards, nailed upon framework, and the boards are covered with tar paper, in order to protect the oil from the elements. Then the reservoirs are ready to receive oil.

The regular quoted price of petroleum at the Kern River oil fields is twenty cents per barrel, but it is reported that some sales have been made recently as low as fourteen cents per barrel; and there is some talk of shutting down a portion of the wells until the surplus oil on hand has been worked off, and the market assumes a more healthful aspect.

The oil from these fields is not of the illuminating variety, but is a heavy oil, with an asphaltum base. It is used principally for fuel, for the manufacture of asphaltum, and for lubricants. It has had the effect to stimulate manufacturing all over the State, and is rapidly taking the place of coal as a fuel on railroad and steamship lines. It is said to be equal in cheapness at present prices to coal at 70 cents per ton; and as California has to pay from $7 to $8 per ton for coal, the value of her petroleum as a fuel may be easily approximated.



INTERIOR OF OIL STORAGE RESERVOIR IN CONSTRUCTION.



ROOFING OVER AN OIL STORAGE RESERVOIR.

The Discoverer of Latent Heat.

On the occasion of "Commemoration" at Glasgow University on April 19, Sir William Ramsay gave an address on Joseph Black, the distinguished chemist and physician, who spent his life between Glasgow and Edinburgh as student and professor in the latter part of the eighteenth century. Medicine, said Sir William, suggested Black's first step in advance toward chemical discovery. Certain curious remedies—in which eggshells, snails, and sundry strange fruits were ingredients—were supposed to be beneficial to those troubled with the stone. Black, then studying for his M. D. degree, endeavored to find some milder solvent for calculus than those generally in vogue, and this led him into an investigation of magnesium sulphate as a substitute for the solution of lime which had, up to then, been used as a remedy. He did not, indeed, demonstrate that "fixed air," as he named the gas with which lime combined to form calcium carbonate, was a compound of carbon, but he did show that a gas can be retained by a solid and made to escape by treatment either with acid or by heat. Later came the discovery of "latent heat," and Black even made a rough determination thereof. His conceptions as to the action of pressure on the boiling point and the absorption of heat by vapor were utilized by James Watt, and effected a revolution in the structure of steam engines. Black's investigations, said Sir William Ramsay, not only laid the foundations of modern physics and chemistry, but profoundly changed the whole of our industrial and social life.

Sewage is treated in Brünn, Moravia, by a chemical process utilizing a reagent composed of 1 kilogramme of organic carbon, 20 to 30 grammes of lime, and 10 of zinc dust per cubic meter of sewage. The carbon is obtained by dry distillation in gas retorts of offal from abattoirs. After mixing with the proper dose of the reagent, the sewage flows into a settling basin, from which the deposited mud is pumped to filter presses. The press cakes are distilled dry and a part of the reagent can be recovered. From the settling basin the turbid water flows to a filter consisting of superposed layers of brick, coke, and carbon. From this filter the clarified effluent is turned into the river.

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AN ARCADE FOR NEW YORK CITY.

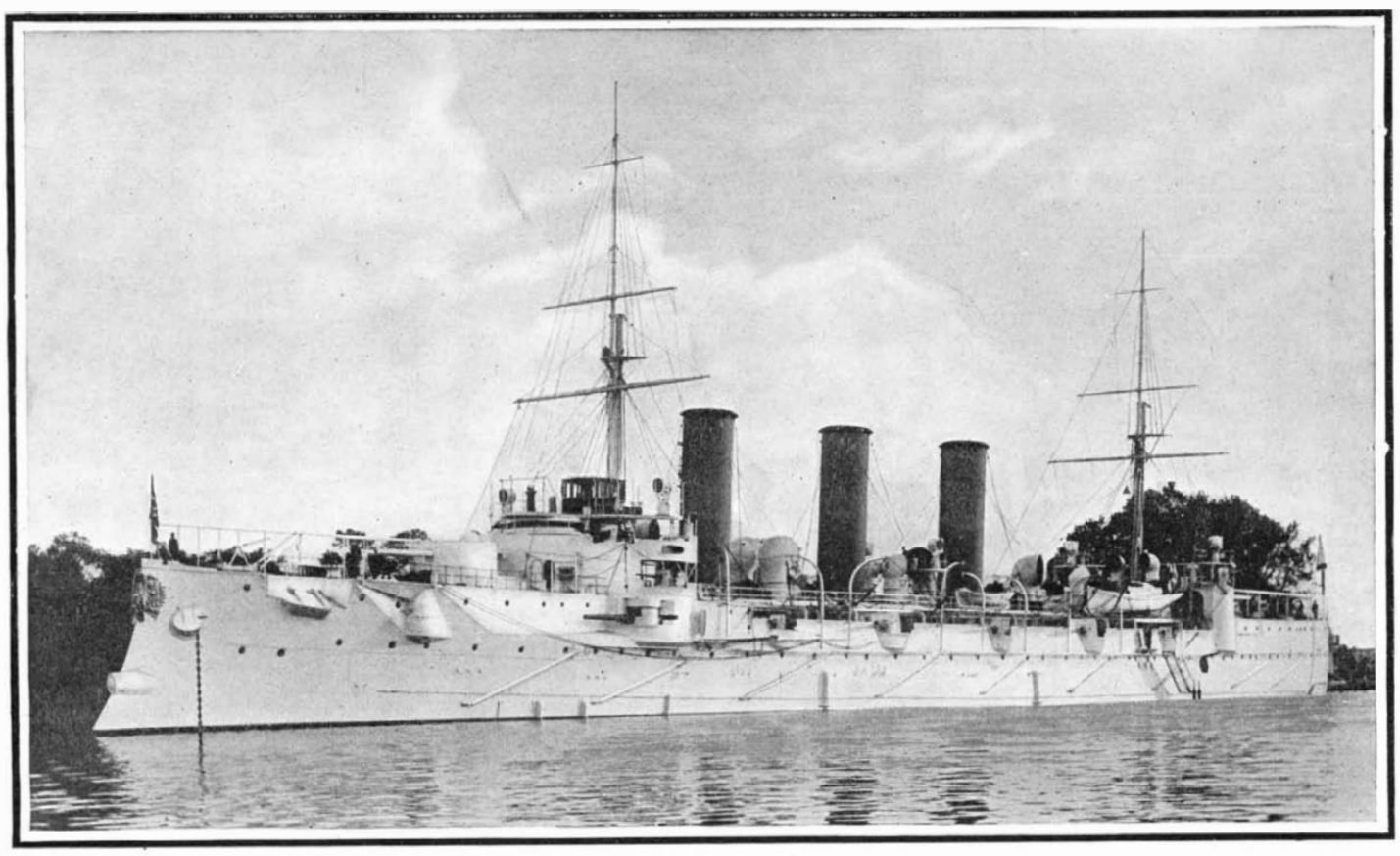
There is a proposition on foot to arcade Nassau Street in New York city. This is a very narrow and congested thoroughfare, and it has been considered that it would be advisable to close it for wagons and trucks, and cover it with a closed arcade. Numerous propositions to this effect have been made. As this is the great highway from the financial district to City Hall and the Brooklyn Bridge, its importance can hardly be overestimated. The principal objection is that in case of a fire it would be impossible to use ladders; but this could readily be overcome by a system of movable skylights, which could be so arranged that they could be swung out of the way at a moment's notice.

Probably the finest example of an arcade in the world is the Galleria Vittorio Emmanuele, Milan, Italy. This is the most spacious and attractive structure of the kind in Europe. It was built in 1865-67 by the architect G. Mengoni, one of the most gifted of modern Italian architects, who unfortunately lost his life by falling from the portal in 1877. The gallery cost $1,600,000, is 1,600 feet in length, 48 feet in breadth, and 94 feet in height. The form is that of a Latin cross with an octagon in the center, over which rises a cupola 180 feet in height. The octagon is adorned and frescoed, representing Europe, Asia, Africa, and America, while the frescoes on the entrance arches are emblematic of Science, Industry, Art, and Agriculture. The gallery contains handsome shops, and is fitted with electric light. This is an admirable example which should be followed in New York.

THE GALLERIA VITTORIO EMMANUELE, MILAN, ITALY.
A similar plan has been suggested for Nassau Street, New York.

WRECK OF THE RUSSIAN CRUISER "BOGATYR."

Now that it is officially announced at St. Petersburg that the protected cruiser "Bogatyr," which recently ran upon the rocks near Vladivostock, has had her guns removed and has been dismantled, to prevent her falling into the hands of the Japanese, this fine ship must be stricken from the list of Russia's available fleet in the Far East. She was a type ship, forming one of a class of five cruisers of practically similar dimensions, speed, protection, and armament. The "Bogatyr" was launched at Stettin in 1900, and was on the Asiatic station when war was declared. Two others of this class, the "Oleg" and "Vitiaz," are building on the Baltic, and the "Kagul" and "Otchakoff" are building in the Black Sea, these four vessels having been launched in 1903. The "Bogatyr" is 423 feet in length, 52 1/4 feet in breadth, and draws 21 3/4 feet, with a displacement of 6,500 tons. The other four vessels above mentioned are 436 feet by 54 feet by 20½ feet, and displace 6,250 tons. The "Bogatyr" carried twelve 6-inch, 45-caliber guns, twelve 3-inch rapid-fire guns, eight 3-pounders, two 1-pounders, and six torpedo tubes. Four of the 6-inch guns were carried in two turrets of 4-inch steel, one forward and one aft, with ammunition hoists extending from these turrets to the protective deck, the hoists having 2 inches of armor protection. Four of the 6-inch guns were carried in four casemates, at the four quarters of the ship, these guns being able to train forward or aft parallel with the keel. Four other 6-inch guns were mounted behind 4-inch shields, two on either beam. The four casemate guns above mentioned were provided with ammunition hoists protected by 2 inches of armor. The 3-inch guns were mounted as follows: Three on either broadside alternating with the 6-inch guns on the main deck, and four at each quarter of the ship upon the roofs of the 6-inch gun casemates. There were also two 3-inch guns mounted on the forward bridge. The vessel was protected by a 2-inch deck, and an important feature was the 2 inches of armor protection around the bases of the funnels up to the level of the quarter-deck. The "Bogatyr" was driven by twin-screw engines of a designed indicated horse-power of 19,500, which, on her trials, gave the ship a speed of 23.45 knots an hour. She had a normal coal supply of 900 tons, and a maximum of about 1,400 tons. Of the six torpedo tubes, two were submerged and were capable of firing 20 degrees abaft of the beam. There was one above water in the bow, another above water in the stern, and two torpedo tubes mounted on the berth deck, capable of being trained through a considerable arc.



Displacement, 6,500 tons. **Speed,** 23.45 knots. **Guns:** 12 6-in., 12 3-in., 9 small guns. **Armor:** deck 2 in., casemates, 4 in. **Torpedo Tubes,** 6.

FAST RUSSIAN CRUISER "BOGATYR," WRECKED NEAR VLADIVOSTOCK.

The "Bogatyr" was an exceedingly fine vessel of her class, and has attracted a great deal of favorable comment. One of our correspondents, indeed, who takes an intelligent interest in naval matters, referring to the excellent protection of most of her 6-inch guns, thinks she bears comparison with some of the so-called armored ships; and he suggests that, considering her much smaller displacement, she seems superior ton for ton to our so-called armored cruisers of 9,700 tons, of the "Charleston" class. The point is made that she brings the same number of unprotected 6-inch guns to bear on either beam, and the same number of guns behind 4-inch armor as the "Charleston;" and our correspondent argues that while the deck is thinner than that of the "Charleston," the coaling capacity is about the same, fewer men are required to do the work, and the "Bogatyr" is about two knots faster. He asks whether a 9,700-ton "Bogatyr" would not be superior to our "Charleston." This, however, is a digression, and we simply mention it as suggesting that if we are to secure the great advantages that go with the armored cruiser type, the belt should certainly be made thicker than the 4 inches that we have given the "Charleston," and it should cover more than a third of the vessel's length.

The "Bogatyr" was the best representative of the protected cruiser type that has yet appeared, and, indeed, she marked about the ultimate development to which this type can be carried. Her untimely end, before she had an opportunity to show her value, will be regretted by naval men the world over.

How the British Museum Was Started.

An observer recalls the interesting circumstances of the establishment of the British Museum. The funds for the institution were raised by a lottery, which was authorized in 1753 by an act of Parliament, the Archbishop of Canterbury, the Lord Chancellor and the Speaker being the managers and trustees, each to receive £100 as an honorarium. The amount of the lottery is said to have been $1,500,000 (£300,000), which was raised by £3 tickets, to provide £200,000 for prizes, varying in value from £10,000 to £10, and £100,000 for the purchase of the Museum's nucleus—the Sloane collections and the Harleian Library — also to provide for the acquisitions and to meet other expenses. It will be remembered that the lottery became notorious through the activities of a certain Peter Leheup, who shrewdly cornered the tickets and had them sold at a premium. Leheup was afterward prosecuted for breach of trust, and fined £1,000.—Harper's Weekly.

One of the immense wagon trains used in hauling borax from Death Valley, Cal., including a train of twenty mules, is to be exhibited at the World's Fair.

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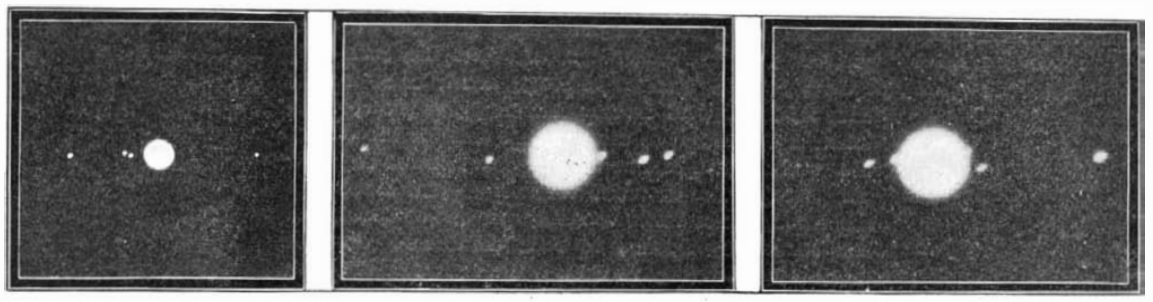
PHOTOGRAPHY OF JUPITER'S SATELLITES.

The satellites of Jupiter form one of the most wonderful aspects of the heavens and, likewise, one of the most easy to observe and most difficult to photograph. In fact, the image upon the plate is small, and the brilliancy of the planet is so great as compared with that of the little moons which revolve around it, and which at the most are of only the sixth magnitude, as to efface any trace that they might leave.

M. L. Rudoux, however, has, in his private observatory at Donville (Mauche), succeeded in fixing the Olympian family upon a plate placed in the focus of his equatorial, which has a 25-millimeter objective. This instrument has a focus of 1.4 meter. During the exposure the planet was followed as closely as possible, since the least deviation is very perceptible with such a focal length. The disk of Jupiter that is seen in the photograph is not its real disk, since lateral diffusion occasions here an excessive enlargement. In the first place, M. Rudoux tried long exposures, say of seven minutes, with an ordinary plate; and then he reduced the time to one minute with a non-halation plate. This short exposure made it possible to follow the planet more closely. The best results were obtained with exposures of from 1 to 1½ minutes.

The photographs taken show that satellite IV., which is the second in size, is always the faintest in photography, while satellite II., although the smallest, is very brilliant, and, with equal surface, the most luminous. M. Rudoux's photographs are the first of a series through which the observatory purposes to study various phenomena. The satellites of Jupiter, in fact, undergo very notable variations in luster, and their systematic notation may lead to interesting researches, such, for example, as those upon their revolution. For this purpose it would be necessary to observe the repetition of the variations, the return of the same brilliancy at determinate positions, etc. In theory, such observations are easy, but, in reality, they are somewhat difficult to make. A long series of them can alone give a solution of the question.



Oct. 7, 1903. Sept. 18, 1903. Sept. 19, 1903.

PHOTOGRAPHS OF THE PLANET JUPITER AND ITS SATELLITES TAKEN AT DONVILLE OBSERVATORY.

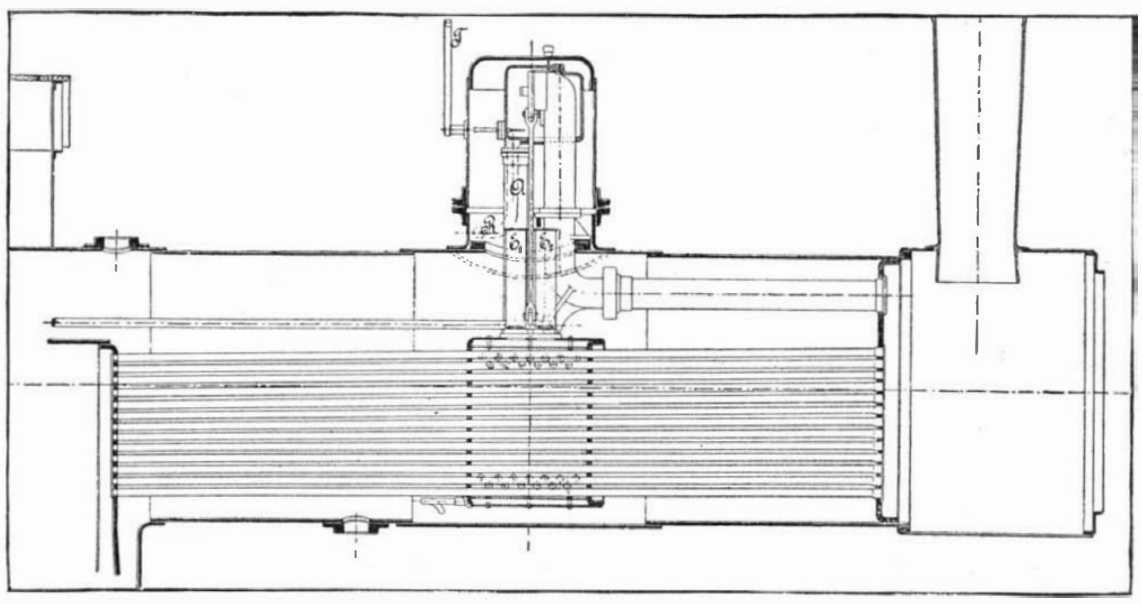
THE PIELOCK SUPERHEATER SYSTEM.

BY DR. ALFRED GRADENWITZ.

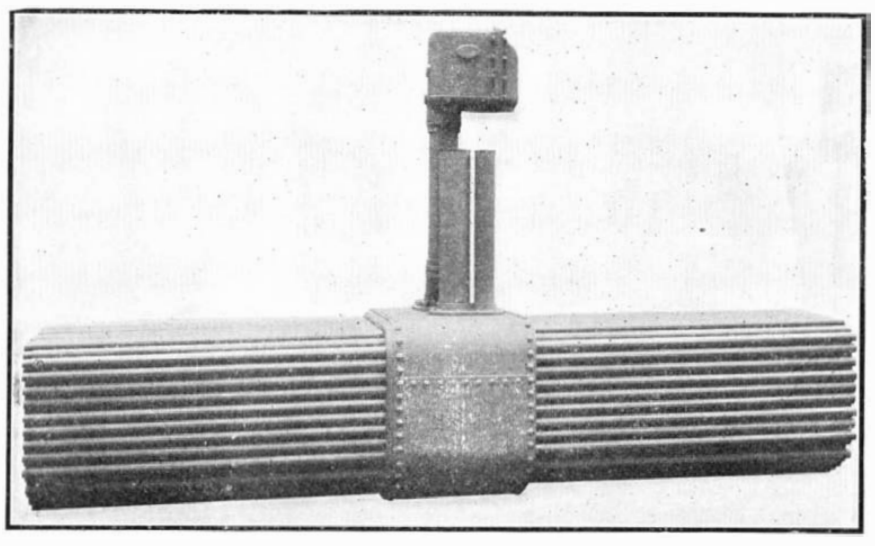
Although the use of superheated steam in stationary steam boiler and steam engine plants was long ago demonstrated to be advantageous, superheaters for locomotives were not designed before 1898, when the Prussian Railway Administration caused extensive experiments to be made in connection with such steam engines. These experiments resulted in proving the superiority of the superheated steam locomotive over the ordinary type being demonstrated.

Now, present superheater types, while fully meeting the requirements of safe operation, cannot be installed without expensive reconstruction except in the case of newly-constructed locomotives, necessitating even in the latter case a not immaterial cost (with the Prussian 2/4 high-speed locomotives about 6,000 to 8,000 marks).

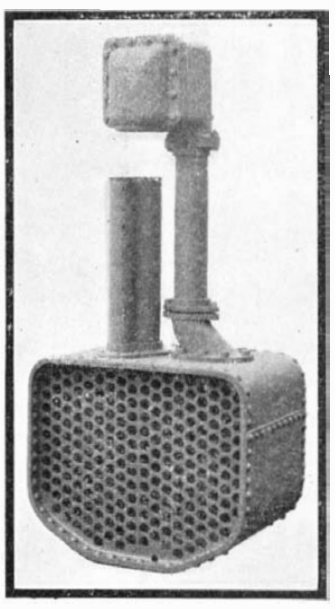
The Pielock superheater (just brought out by the Hannoversche Maschinenbau A. G. vorm. Georg Egestorff, Linden near Hanover) is remarkable for its simplicity and suitable arrangement, in addition to its low cost. This superheater is designed not only for locomotives, but for nearly any hot tube boilers. It is readily installed in connection with new as well as with existing boilers. In the case of locomotive superheaters, the apparatus is placed in the multitubular boiler, using the existing heating surface of the tube, so as to have the fire gases, necessary to superheat the steam, enter the superheater at a convenient temperature, sufficient to obtain the required steam temperature with a minimum heating surface, being on the other hand sufficiently cool to prevent the fire gases from seriously injuring the tube. The superheater consists mainly of a box surrounding the existing tube system in the boiler, being readily tightened against the surrounding water, as the pressures in the superheater box and in the boiler are identical. This box is divided by partition walls into different compartments, this insuring a contact as prolonged and as intimate as possible of the steam and the heating tube. The steam enters the superheater box at boiler pressure through the inlets E_1 and E_2, when the steam traverses the various compartments and ultimately finding its way through the tube A, enters a box surrounding the governor head ("Regulatorkopf"). The temperature of the superheated steam is indicated by a thermometer T provided with large figures, so as to be easily read from the mechanic's stand. A tube, R, leading from the governor through the dome foot serves to supply superheated steam to the air pump as well as for cleaning the rails, heating, etc. If disturbances should be observed, the amount of leakage of the superheater may be ascertained. Experiments so far made on the Pielock superheater have fully borne out the claims of its inventor. In connection with experiments made on behalf of the Prussian railway authorities, a saving of coal as high as 15 per cent and of water as high as 18 per cent was noted as compared with similar wet steam locomotives. In virtue of the reduced space of the superheater, any desired temperature up to the maximum of 300 to 350 deg. may be obtained, according to the position and length of the apparatus.



Arrangement of Pielock Superheater in a Locomotive Boiler.



Superheater with Tube System.



End View.

THE PIELOCK SUPERHEATER SYSTEM.

Dr. Pupin's Lecture on Wireless Telegraphy.

On the evening of May 25, at one of the lecture halls of Columbia University, Prof. M. I. Pupin gave, under the auspices of the New York Electrical Society, a lecture upon the subject of wireless telegraphy.

Dr. Pupin devoted his remarks largely to "resonance"—a subject concerning which there is a good deal of confusion in the popular mind.

There are, he said, three distinct kinds of electrical resonance, to wit:

1. Simple resonance, which is the commonest type, and is analogous to the resonance of a sounding body, such as a bell or a stretched string. Simple resonance is manifested whenever the electrical state of a conducting body is changed abruptly, as when a simple metallic body is charged by a spark from a Leyden jar. The simple resonance of a body is changed most conveniently by altering its inductance or capacity.

2. Multiple resonance, which appears when a composite structure, built up of a number of conducting bodies, each having simple resonance, are connected together into a unitary system. In this case the system as a whole can have as many frequencies as there are simple resonators in its make-up. For instance, if the system comprise ten simple resonators, each having an individual frequency, the system is capable of manifesting ten frequencies at the same time, provided the ten simple resonators are all in action.

3. Selective resonance, whereby one or individual circuits, or several circuits connected together in a system, may select or pick out, from a system adapted for multiple resonance, vibrations or oscillations of definite frequency or of some other definite characteristic. For instance, if a system of ten resonators is impressing waves of ten different frequencies upon the ether, or is impressing alternating currents of ten different frequencies upon a single wire, or is impressing alternating currents of ten different voltages upon the wire, it is possible for a number of receiving instruments, actuated by the waves or by the currents as the case may be, to respond independently, and without interference of any sort one with the other.

He explained the multiple selective system of his own invention, and which, with slight modification, is adapted for use with either electromagnetic waves acting through space or with alternating currents traversing a wire. He exhibited a model of his system as applied to wire telegraphy, but as the apparatus was not in working order, no practical demonstration was made.

Large Boring for Water-Works.

The largest boring for water-works purposes in England was recently completed for the Gainsborough Urban District Council. According to the Engineer, this borehole is 1,515 feet deep, and was not sunk without some annoying delays. One of these was particularly serious. When a depth of 725 feet had been reached, the rope carrying the boring tool broke, and buried the tool. This accident caused an interruption of no less than twenty-two months, but eventually the tool was recovered, and the boring completed to its full depth in 1900. Pumping machinery designed to have a maximum capacity of 70,000 gallons per hour has been installed.

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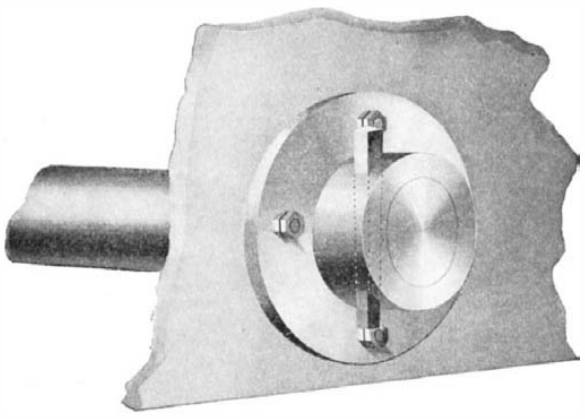
Patent Department

SHAFT FASTENING.

In very heavy machinery, such as stone crushers and the like, where the parts are subjected to excessive strain or jarring, it is important to provide a simple,

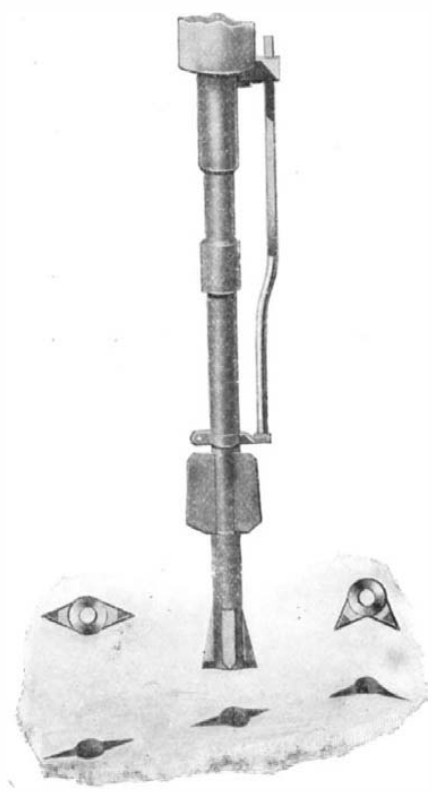


SHAFT FASTENING FOR HEAVY MACHINERY.

yet substantial means by which a shaft may be secured solidly and immovably in position within the frame of the machine. Mr. William A. Jones, of Branch, Pa., has invented a device of this character. It consists of a flanged sleeve which fits on to the shaft and is secured to the frame by bolts passing through the flange. The sleeve is formed with an inner hub, not shown in our illustration, which is conical and fits into a tapered opening in the frame of the machine, so that by tightening the bolts this hub will be wedged snugly and securely in place. The shaft is held to the bushing by a taper key which is driven into coincident slots formed in the bushing and shaft. The key should be located on the opposite side of the shaft from that on which the strain or pressure is to be exerted. This arrangement will be found advantageous because the shaft will not be weakened by the key slot on the side which bears the greatest pressure. In practice two of these fasteners will be employed on each shaft, one at each end, and as an added security against lateral displacement, the shaft may be turned to a smaller diameter at one end, thus forming a shoulder against which the conical hub at that end may abut.

ROCK DRILL ATTACHMENT.

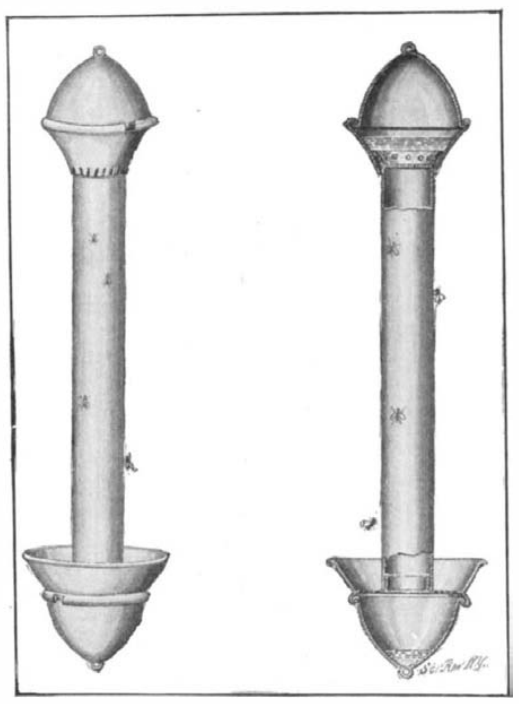
In process of drilling rocks in quarries to form slabs or blocks, it is customary to produce holes in the shape of an ellipse, the holes being disposed in a row along the line of fracture, and the line coinciding with the long axes of the ellipses. We illustrate herewith an improved rock drill attachment, invented by Mr. David Awst Owen, of Granville, New York, which is designed to drill a hole with V-shaped grooves in its wall extending in the direction of the straight or angular line of fracture. The usual drill has the shank turned down to form a reduced portion, on which a cutter is mounted to turn. The cutter comprises a hub with wings extending lengthwise of the hub, either diametrically in alinement, or at angles one to the other, as clearly indicated in our illustration. In operation when the rock drill is set in motion to drill the holes in the usual manner, the cutter moves up and down with the drill, but does not turn with it. After the hole has reached a depth sufficient for the lower ends of the wings on the cutter to strike the rock, the V-shaped grooves will begin to be formed in the side walls of the drill hole. When a corner is reached in the line of cleavage, that cutter is used which has its wings extended at right angles one with the other. When the drill holes are completed and charged with explosives, and the latter ignited, then the rock will split along the line of cleavage much more evenly than with elliptical holes, particularly at the corners. When it is desired to sharpen the drill or the cutter, the several parts can be readily disconnected to allow sharpening. The device is very simple and durable in construction, not liable to easily get out of order, and can be readily applied to rock drills now used, it being only necessary to change the shank of the drill to accommodate the cutter.



ROCK DRILL ATTACHMENT.

A NOVEL FLY-CATCHER.

A new form of fly-catcher has been invented by Mr. Johann Zierl, care of Mr. W. J. Miller, Ballinger, Texas, which consists of a standard or post covered with a tacky substance which will attract the flies and hold them fast. This device is arranged to be suspended in any convenient place, and, as shown in our illustration, is made up of a metal tube, in the upper end of which a flared attachment is fitted, this constituting a holder or reservoir for the tacky substance employed. To the lower end of the tube, a bowl is attached, which serves as a holder for the flies,



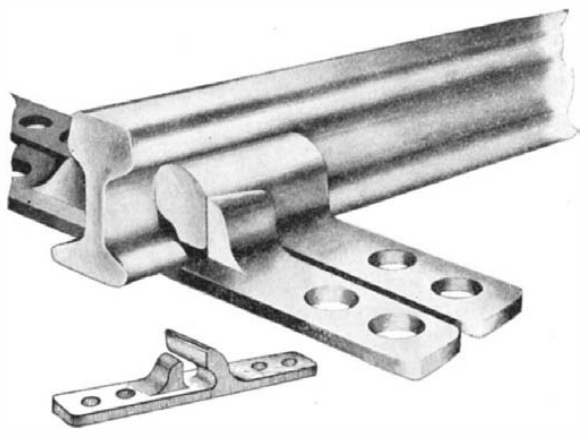
A NOVEL FLY-CATCHER.

and each end of the device is covered by a cap of conical form. The lower end of the flared reservoir is provided with openings, which register with perforations in the tube, and through these the tacky substance flows from the reservoir, down over the tube, smearing its entire surface. The adhesive substance is sweetened or otherwise made attractive to flies, which, when they alight on the tube, are held fast and slowly carried downward to the bowl by the flow of the sticky fluid. A sieve forms the bottom of the bowl and serves to retain the flies, while the fluid passes on into the cap below. When the reservoir is nearly emptied of the tacky fluid, the caps are interchanged, thus supplying a fresh quantity for the reservoir, and permitting the flow to continue without interruption. The caps are held in place by a form of bayonet joint, that is, each cap is provided with a lug adapted to engage the flanged edge of either the reservoir or bowl, both of which are provided with notches through which this engagement may be effected.

A fly-screen built on the principle of a roller shade has been invented and patented by Melchior Zugermayer, of East Rutherford, N. J. The screen is contained in a small casing which is secured to the window casing and which is hardly noticeable. A connection is provided, so that the screen will follow the movement of the sash. This connection can be easily broken, when the sash will work independently. With one of the screens on the upper and lower portions of the window, the entrance of insects of any character will be effectually prevented.

IMPROVED RAILWAY CHAIR.

The greatest strain on a railway track comes at the joints, and it is rather an unfortunate circumstance that the parts which are subjected to the greatest strain must be weakened by bolt-holes necessary for securing the fish-plates. A recent invention, however, provides a very efficient means of securing rails to each other and to the roadbed at the joints, and at

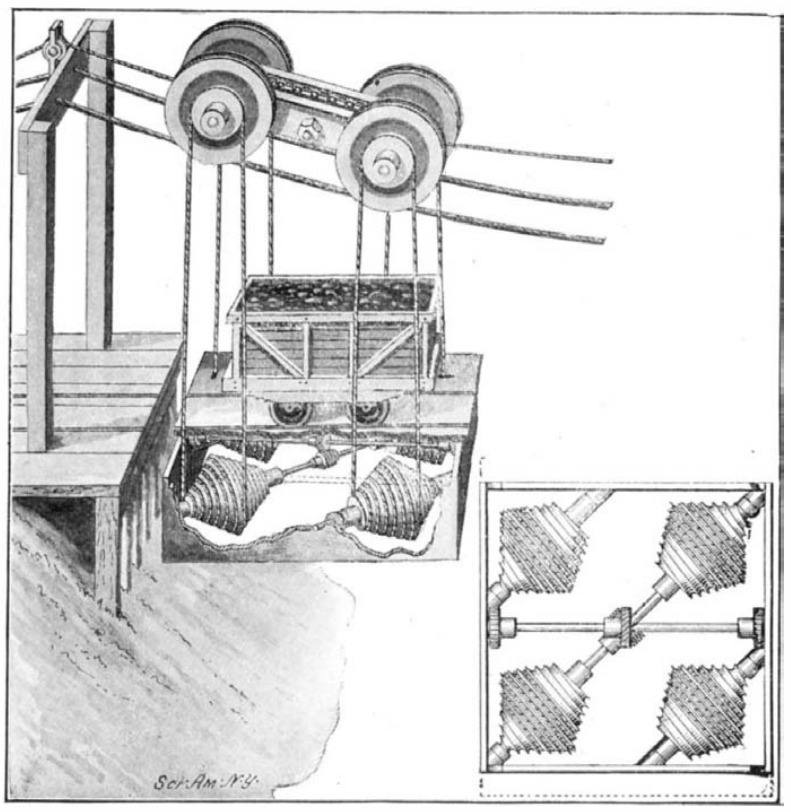


IMPROVED RAILWAY CHAIR.

other places as well, without the use of any bolts. Our engraving illustrates this invention, which is to be accredited to Rev. Francis W. Pool, of Havre, Mont. This improved railway chair comprises two identical members of the form shown in our detail view. Each member is formed of a metal plate with two upwardly projecting jaws thereon. The larger one of these jaws is provided with a lateral projection which is tapered along its outer face to lie parallel with the beveled or tapered inner face of the smaller jaw. In use the two members are placed under the rail, parallel to each other, but at right angles to the rail, so that the large jaw of one member will lie against one side of the rail, and the large jaw of the other member will lie against the other side of the rail. Now, on moving these members together, it will be observed that the taper face of the smaller jaw on each member engages the tapered projection of the larger jaw on the other member and serves as a wedge to tighten its grip on the rail flange and web. When the members have been tightly driven into engagement with each other, and the rail, they are held in place by spikes driven into the ties.

COMPENSATING DEVICE FOR ROPE TRAMWAYS.

By means of a very ingenious arrangement of compensating drums, Mr. William Y. Cruikshank, of Freeland, Pa., has produced an overhead traveling carriage for use on suspension cables stretched across rivers and the like, which will travel in horizontal position throughout its course, and which will furthermore act as a brake on the down grade, and as a power to assist the propulsion on the up grade of the cableway. The greater the load carried, the greater will be the down-grade friction and the up-grade power developed. As shown in our engraving, the carriage consists of a platform supported on a frame, in which the compensating drums are journaled, and from the latter, endless



COMPENSATING DEVICE FOR ROPE TRAMWAYS.

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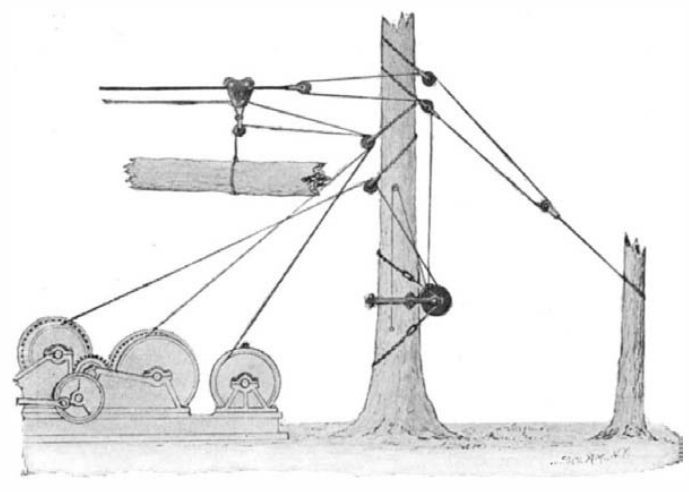
ropes pass upward over pulleys formed on the wheels which travel on the cables. The compensating drums are of a double cone shape, and are spirally grooved to receive the coils of the ropes, the number of coils on each drum being equal to one-half the number of turns of the spiral groove. The compensating pulleys are disposed at an angle with the axes of the cable wheels, for the purpose of holding the ropes at all times in alinement with the pulleys. When the carriage is in motion, the pulleys rotating with the cable wheels cause the ropes to unwind from one-half of each compensating drum and onto the other half. On the ascent, each rope unwinds one strand toward the drum's greatest diameter, when the other strand winds onto the drum's smallest diameter. As the carriage ascends, the grade is constantly increasing, and the purchasing power is in the same ratio increasing in favor of the strand that is unwinding toward the greatest diameter of the drum. This power is transmitted to the pulleys, and assists in revolving the cable wheels, thereby assisting in propelling the carriage up grade. The reverse holds true on the down grade. That is, the carriage is raised toward the cable wheels on the down grade at a gradual rate and then lowered on the up grade at an accelerated rate. By varying the positions of the rope coils on the forward and rear drums, it is evident that the forward end of the platform may be made to rise more slowly than the rear end on the descent, and *vice versa* on the ascent, thus keeping the platform in horizontal plane.

As the ropes wind on and unwind from the drums there will be a lateral movement of the carriage, and in order to keep the center of gravity of the load at the same point, a compensating movement is provided as follows: A rack formed on each end of the platform is engaged by a pair of spur gears secured to a shaft, which is rotated by worm gear connection with a pair of the compensating drums, as shown in our detail view.

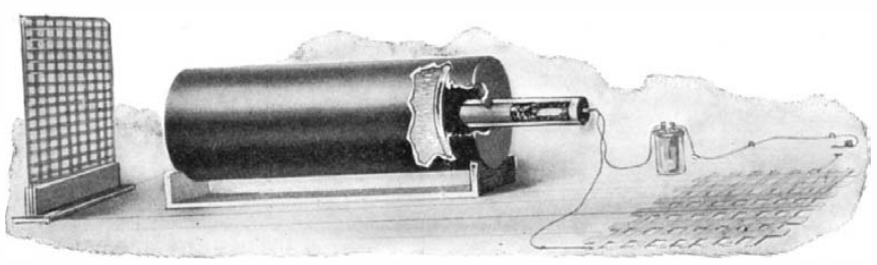
A TENSION REGULATOR FOR OVERHEAD CABLES.

The accompanying illustration shows a new tension regulator invented by Messrs. John F. McKay and David J. McKay, of Bowie, La., which is adapted particularly for regulating the tension of overhead cables used in lumber camps for transporting logs through the forest from place of felling to the railroad. The improved apparatus is capable of safely manipulating cables of the largest size and greatest length, and will permit of rapid change when it is desired to shift the position of the cable lines. It will also relieve the strain on the hoisting drum after the cable has been placed under a desired tension. It will be observed from our illustration that the main cable is secured to the strap of a running block which may be adjusted toward or away from the supporting tree by means of a tension cable which, through suitable tackle leverage, is connected to a tightening drum. The tension cable is fastened at one end to the strap of a standing block secured to the supporting post or tree, and thence passes in succession over a tail block secured to an anchor post or stump, a second guide block secured to the tree, the block on the main cable, and back to the first standing block, over which it passes to the tightening drum. The latter is supported in a U-shaped frame, provided with two arms which extend on either side of the supporting tree, and which may



A TENSION REGULATOR FOR OVERHEAD CABLES.

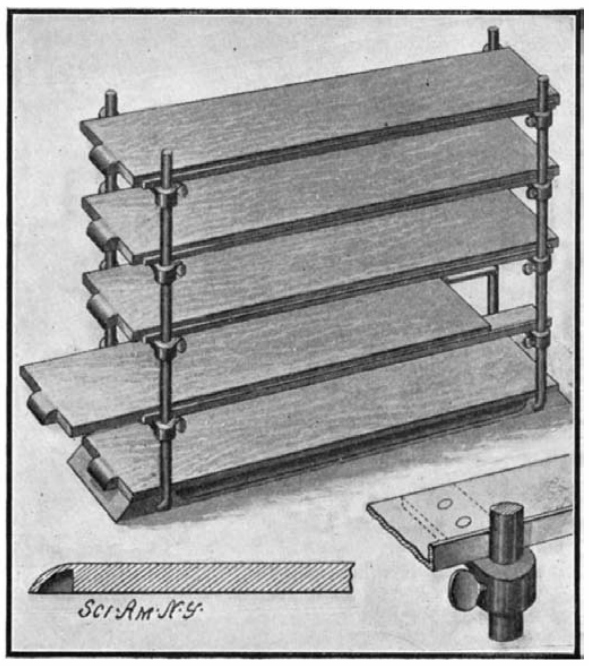
be firmly secured thereto by means of a chain and a locking hook. The device is further strongly braced by guy chains, as shown. The tightening drum is formed with two barrels, the smaller one to receive the tension cable, and the larger one for a second cable, wound in the opposite direction, which passes to the winding drum of the skidding engine. When the latter cable is wound up on the winding drum, it rotates a tightening drum and thereby places a tension on the main cable. A dog engaging a ratchet on the tightening drum takes the strain of the tightening cable when the drums are at rest. A most important feature of the invention resides in the manner of securing the blocks and cables to the tree, whereby the probability of an accident due to the falling of any portion of the overhead structure is almost entirely avoided, thus eliminating to a large extent the danger heretofore incident to work in the vicinity of overhead structures.



DEVICE FOR DISTRIBUTING NOXIOUS FUMES.

A CLOTHING RACK.

In clothing stores considerable confusion is apt to arise from the promiscuous piling of clothing of all sizes on the same counter or table. This confusion is usually the result of a lack of suitable storing facilities. In order to ameliorate such conditions, Mr. John A. Hockersmith, of Norfolk, Nebraska, has invented an improved clothing rack of simple construction, in which trousers of different waist and inseam measurement may be placed and separated as to sizes, thus making it convenient to quickly find a garment of any desired size. As shown in our illustration, the trousers rack consists of two U-shaped rods, which form the uprights on which the shelves are supported. The horizontal portions of the uprights fit into grooves in the bottom of the baseboard, and are secured thereto by screws. Brackets are adjustably mounted at desired intervals on the uprights, to which they are secured by the tightening of thumb screws. Rigidly connected to opposite brackets of a side are flanged plates, on which the shelves are mounted to slide. Each shelf is formed with a handle at one end, and on these handles different sizes of waist and inseam measurements may be placed. An important feature of this improved rack is the fact that the space between the shelves may be varied at will, according to the quantity of clothing which is to be carried by the shelves.



TROUSERS RACK FOR CLOTHING STORES.

William F. Oesterle, who recently graduated from the Indiana University, and O. W. Brown, an assistant of chemistry at the same institution, have invented a process of smelting ore by electrical means which is said by them to represent great economy over the present method of doing this work. Instead of the cumbersome clay retorts now in vogue around smelting works, these gentlemen make use of a furnace of their own design, and the metal runs out in streams while the ore is being treated. The roasting of the ore, now a source of considerable expense, will be entirely done away with, and an enormous saving of labor will result. Mr. Oesterle says that with his furnace four men will produce as much ore in a given time as one hundred men now do. Mr. Oesterle is thoroughly familiar with the subject, as his father has a large zinc plant at Marion, Ind. This invention was begun while the junior Oesterle was attending the high school, and he took a special course at the Indiana University in electro-chemistry for the purpose of completing the details of the process. Here he confided his plans to Mr. Brown, and since they have worked together.

DEVICE FOR DISTRIBUTING NOXIOUS FUMES.

The usual type of burglar alarm is arranged to sound an electric gong and arouse the occupants of a room or building on entrance of a burglar, but such an alarm obviously affords little, if any, protection for isolated buildings such as country stores, or the like, which are unoccupied during the night. For such buildings, what is needed is a device which will cope with the intruder himself, and not merely sound an alarm. We show herewith the method of dealing with such a case invented by Mr. Lyman M. Beckes, of 609 Main Street, Vincennes, Ind. It consists in a means for distributing noxious fumes in a room or building on entrance of the burglar, so as to overcome the man and prevent him from carrying out his unlawful designs. The noxious material, which preferably consists of formaldehyde, is held in a light steel cylinder, closed by a cork at one end and by a wall at the other. A small tube closed at its outer end is threaded into this wall, and serves as a holder for a charge of gunpowder. A plunger in the cylinder is formed with a shank which fits into this tube against the powder. A fine heating wire inserted into this charge is connected in series with an electric battery circuit. The circuit, however, is normally open, but is so arranged that by stepping on a door mat or in some similar way, the burglar will complete the circuit, igniting and exploding the charge, which will force the plunger and cork out, and discharge the formaldehyde. By arranging a screen before the muzzle of the cylinder the material on striking the meshes will be considerably diffused, and the rising fumes will make it impossible for the burglar to remain in the room and retain consciousness.

AN IMPROVED PORTABLE TENT.

We illustrate herewith an improved portable tent which is light and roomy, very strong and durable, and capable of erection very quickly in a storm-proof and reliable manner, either on rocky, sandy, or loam soil. The use of ridge poles, upright and inclined posts, and the numerous belaying pegs usually employed is entirely dispensed with, and in their place a pair of detachable frame arches and several anchors are used. Each frame, as shown, is made up of two straight and two curved wooden sections, and is braced by a rod formed at the ends with pins, which fit into sockets in the ends of the frame. The frame sections are held together by metal socket pieces or couplings. In erecting the tent, the two frame arches are spaced apart at a suitable interval, and the tent cover is drawn over them. This covering is made with strapped seams, and is approximately semi-cylindrical in shape, with tapered ends, as illustrated. The latter are secured by pegs driven into the ground, and guy ropes extend from the top of the frame arches to a suitable anchorage on each side of the tent. If the tent is erected on rocky ground, a hook may be used to anchor the guy ropes, but in sandy ground the anchor is formed of a metal plate, from the periphery of which several wire strands extend to a common ring, to which the guy rope is secured. The tent covering is formed along its edge with an outwardly-extending flange, and the door of the tent opens into one or both of the tapered ends. Curtains separate the main body of the tent from these tapered ends. The inventor of this improved tent construction is Mr. Frank H. Gotsche, 416 Hoffmann Avenue, San Francisco, Cal.

IMPROVED PORTABLE TENT.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

RAIL-SUPPORT.—L. STEINBERGER, New York, N. Y. The invention relates to an insulated support, and is particularly adapted for use in supporting and insulating a third rail of an electric railway, although it may be used for insulating and supporting various other electric conductors. One object is to provide an insulated conductor-support which will permit the rail ample freedom of movement in any direction, thereby providing for the expansion and contraction of the rail and for the vertical movement of the ties. Another, is to relieve the supports of strains and permit the rail to accommodate itself to positions of the collector-shoe, thereby insuring a constant and perfect contact.

Hardware.

REVERSIBLE SOCKET-WRENCH.—W. W. MURCH, New York, N. Y. In this patent the object of the invention is the provision of a new and reversible socket or nut wrench which is simple and durable in construction, easily manipulated, readily reversed, and more especially adapted for screwing axle-nuts on or off the axles.

JAW-WRENCH.—W. W. MURCH, New York, N. Y. The object of the invention in this case is to provide a new and improved jaw-wrench arranged to permit the operator to readily open or close the jaws to snugly fit the article to be turned and to allow convenient turning of the jaw-carrier and the jaws thereon in either a forward or backward direction.

Heating and Lighting.

STEAM-GENERATOR.—P. G. A. PEUGEOT, 83 Boulevard Gouvion St. Cyr, Paris, France. This invention relates to an improved boiler for the instantaneous production of superheated steam, which as in others of this class, comprises strong tubes which are brought to a high temperature within a non-conducting casing and constitute a tubulous system to which water under pressure is fed at one end and from which steam is supplied at the other in a more or less dry or superheated condition.

METALLURGICAL FURNACE.—E. C. WILLS, Altoona, Pa. That class of furnaces designed for the reduction of ore and for the melting of pig-iron and other metals is improved by this invention. Mr. Wills seeks to provide hearth-like surfaces down which the ore and metal may feed by gravity, and subject the materials so fed to the action of a flame from an oil-burner independently of or in conjunction with the heat from an ordinary furnace.

CHIMNEY-COWL.—B. S. WHITTON, Louisville, Ky. In this patent the invention is an improvement in chimney-cowls. The inventor seeks the provision of means whereby to prevent downdrafts and increase the upward draft, giving a powerful updraft to the chimney. The cowl may be made of galvanized iron, copper, terra-cotta, cast-iron, or any desired combination of these materials.

Machines and Mechanical Devices.

MUSIC-LEAF TURNER.—W. H. SAFFORD, JR., New York, N. Y. In this music-leaf turner the rods range longitudinally between the leaves and the upper ends have arms carrying clips to engage the individual leaves. The rods are spring-acted and normally tend to open the leaves. Spring-acted key levers act to release rods in succession. The invention admits of general use.

COFFEE-MILL.—S. T. WALLACE, Los Angeles, Cal. Mr. Wallace's invention has reference to improvements in coffee-mills, an object being to provide a mill of simple construction having novel means for adjusting the rolls of different degrees of grinding and by means of which the grinding may be rapidly done. By employing rolls, the mill has a much greater capacity than mills having disks.

PRESSURE MECHANISM.—E. T. WOLF, New York, N. Y. In this mechanism the pressure can be applied uniformly to all parts of tapering material or work. It may be used in a variety of arts, and in machines of any character for subjecting irregular or tapering stock to pressure. One way it can be used resides in a machine for making piano-hammers disclosed in a former application by Mr. Wolf, in which variation in the materials or stock makes it difficult to apply pressure uniformly to the materials at all points. This practical objection is wholly overcome by the use of mechanism embodying the present invention.

MACHINE FOR SKINNING TOMATOES.—J. E. TRIMBLE, Albany, Ind. Mr. Trimble's invention is an improvement in apparatus for use in removing the skins from tomatoes, and has for an object to provide means whereby suction may operate in connection with the perforated bed to draw the skins from the tomatoes and to permit the pulp to discharge with the skin removed.

DREDGE ATTACHMENT.—H. A. FUNKE, Elizabethtown, New Mex. The attachment is especially adapted to dredges in which the buckets are arranged on an endless chain and dumping as they turn over at the upper portion of the dredge. In this class of dredges especially when working in clay and stiff soils the buckets fail to dump the mud completely. To overcome this a scraper device automatically enters each bucket as it arrives at dumping position and throws out therefrom all the accumulated material. This device may be driven either by gearing direct thereto or by contact with the buckets; the latter arrangement being preferred by this inventor.

DUPLICATOR.—C. H. EPPLE, New York, N. Y. The intention in this improvement is to provide a device that may be easily operated, and by means of which a permanent record of the orders or sales may be made for the use of an accountant or cashier and at the same time duplicate the written matter on a check to be presented to a customer for settlement.

GUMMED-STRIP-MOISTENING MACHINE.—J. E. COLVIN, Junction City, Kan. This improvement has for its object the provision of a strip-moistening machine which will contain gummed paper strips of appropriate length and width and be adapted to deliver these gummed strips in moistened condition as may be required for application to a filled paper bag or other package for its sealed closure.

ATTACHMENT FOR CUTTER-BAR SHARPENERS.—W. M. PNEUMAN, Meshoppen, Pa. In general terms, this invention consists of an attachment whereby the grinding-wheel may be gaged in its work. The particular type of cutter-bar sharpener to which the gage attachment is adapted employs a rotatable grinder at the free end of an oscillating arm. In sharpening cutter-bars with a device of the character stated the grinder is liable to cut away the blade injuriously and care is needed to prevent grinding through the bar or blade. Mr. Pneuman's attachment obviates all such objections and has the advantage of adjustability.

Of Interest to Farmers.

SULKY-PLOW.—J. E. RUSSELL, Titonka, Iowa. One of the objects in this case is to be able to change the inclination of the plow to the ground in such a manner that the tilting of the point down to make it run deeper does not involve the raising of the heel of the plow, and vice versa, but when the point of the plow is tilted down the whole lay of the plow is tilted down about a center in rear of the beam.

PLATFORM ATTACHMENT FOR COMBINED HARVESTERS AND THRESHERS.—F. MCCOWN, A. G. LOUNDAGIN, and W. A. WILLIAMS, Walla Walla, Wash. Their invention relates to an improvement in that class of combined threshers and harvesters or "combined harvesters," as they are called, which are provided with a side platform adapted for supportng one or more harvest hands while sacking grain, sewing the filled bags, and delivering them upon the ground.

COTTON, BERRY, OR VEGETABLE PICKING OR DAIRY STOOL.—J. C. FARLEY, Ennis, Texas. The object in this instance is to provide a construction which can be conveniently secured to the wearer, can be conveniently adjusted to form a stool of any desired height, will not interfere with the wearer walking from place to place, and will readily adjust to position for use when the operator stoops over, as in the act of milking, or picking berries, vegetables, cotton or other objects near the ground.

HAY-STACKER.—O. D. STALCUP, Unionville, Mo. The purpose in this case is to provide a stacker which can be operated close to the stack, thereby enabling an operator to keep the stack upright and in desirable shape. Another, is to so construct the stacker that springs or weights are not required to start it back on the return from its upright position and to so construct the draft device and mountings for the carrying-head that the head may be operated without interference, no matter how close the device may be to the stack.

Prime Movers and Their Accessories.

SANDER FOR LOCOMOTIVES.—G. W. FRAZIER, Alamogordo, New Mex. The object in this invention is to provide an apparatus which is adapted for depositing sand upon rails by means of an air-blast and which in case of failure of the air-supply may be used simply as a gravity-sanding device, the sand flowing by its own weight from the sand-box to the rails.

ROTARY ENGINE.—S. M. WADE and G. E. GARNER, Andover, Ohio. In carrying out the present improvement an object of the inventors is to provide an engine, the internal revoluble disk of which is supplied with a plurality of spring-tensioned pistons designed to be operated by the pressure of steam within the casing of the engine for the purpose of turning a power-shaft.

Pertaining to Vehicles.

BRACE ATTACHMENT FOR PIVOTED DRAFT-BARS OF VEHICLES.—L. H. PLANK and A. C. PLANK, Rochester, Minn. In this patent the object of the invention is to provide an adjustable brace for the combined draft and pivot-bolts of doubletrees and swingletrees, whereby the bolts are supported in such manner as to be capable of withstanding great draft strain without danger of bending or being broken.

VEHICLE-WHEEL.—W. D. WILLIAMS, Salt Lake City, Utah. The aim in this improvement is to provide details of construction for a wheel which afford a neat, strong, and durable wheel whereby the spokes of the wheel may be quickly and conveniently removed singly or in any number, and furthermore, enable the assembling of all parts of the wheel without heating by the use of a hammer and wrench.

Of General Interest.

THERMOMETER-CASE.—H. A. SIEVERT, Fort Walla Walla, Wash. In this patent the invention relates to improvements in an antiseptic case especially designed for use of physicians and surgeons. Primarily the object in view is to provide a case adapted to contain an antiseptic liquid within which the thermometer is at all times bathed when in the case, the construction of the case being such that the thermometer may be withdrawn while the case is in any position.

SPATULA AND CORK-EXTRACTOR.—E. B. JELKS, Quitman, Ga. Mr. Jelks' invention is an improvement in spatulas, being in the nature of a combined spatula and cork-extractor. It will be found especially useful by druggists in filling prescriptions, the spatula being used in the ordinary way and the extractor for removing the corks of the large-mouthed bottles employed in drug-stores for holding different drugs employed in prescriptions.

WHEEL-OILER.—W. D. GRAVES, Brown Valley, Minn. This oiler may be applied to a lose pulley or any form of a wheel revolving on a stationary shaft. The purpose of the invention is to provide a suitable oil-receptacle that can be readily attached to a pulley or other wheel revoluble on a shaft between the portion of the hub containing the oil-passage and the opposite inner face of the rim of the wheel.

MARLINESPIKE.—F. KAPPLER, JR., Lake Linden, Mich. In use the spike may be inserted between coils of the rope, and then forced through the rope until the overlying coil of the rope will stand between the lateral opening in the spike and the butt-end of the spike. The end of the coil can then be inserted through the bore and be directed by an incline out through the lateral opening to form a con yenient hand-hold for use in drawing the coil between the coils desired to splice.

MUSIC-LEAF TURNER.—W. PILOT, Denver, Col. This invention refers to improvements in music-leaf turners, an object being to provide a device for this purpose that shall be simple in construction and inexpensive and by means of which music may be quickly turned without interfering with the playing of an instrument.

MOORING-ANCHOR.—M. SHEPARD and T. S. WIMPENNEY, Edgartown, Mass. In this patent the invention has reference to improvements in mooring-anchors for vessels, an object being to provide an anchor that may be readily set in a water-bed or taken from the water-bed at any time and that will be practically impossible to draw out by the strain or pull of a vessel attached thereto.

TABLE.—T. S. USHER, Brantford, Ontario, Canada. Mr. Usher's invention is an improvement in tables, more particularly such as are adapted for use in playing cards, and are so constructed that they may be knocked down and packed in small places for storage or shipment. The invention is embodied in the improved construction of the supports for the table and the attachment of the same to the table-top.

SMOKELESS FUEL.—T. WEEPLE, Oakland, N. J. According to this invention Mr. Weeple employs a simple method of treating such carbonaceous substances as bituminous coal, coal-dust, oil residue, and the like as will produce a fuel that will burn free from "black smoke" during combustion, while retaining all its caloric properties, thus making the fuel especially available for domestic and steam purposes.

GARBAGE-CAN.—R. METZ, Atlantic City, N. J. This invention relates to improvements in cans for holding garbage, an object being to provide a can for this purpose with a practically air-tight cover and having means for disinfecting the interior of the can and also the space between the cover members, whereby germs will be effectually destroyed and odors prevented from escaping.

DETACHABLE BUTTON.—A. H. BROWNLEY, Onehunga, New Zealand. Mr. Brownley's invention has reference to detachable buttons—that is to means for securing buttons so that the same may be quickly and easily removed from the clothing. While his invention admits of general use, it is of peculiar value to soldiers and sailors for use in connection with their uniforms.

BOTTLE-STOPPER.—G. MILLER, New York, N. Y. This invention has reference particularly to improvements in stoppers for milk-bottles. Milk-bottles are often broken by the freezing and consequent expansion of the milk therein. The object is to provide a stopper or closure for the bottle so arranged that it will readily yield to the expansion strain, and thus prevent the breaking of the bottle.

HANDLE.—E. F. SMITH, Newfield, Maine. The aim of the invention is to provide a handle designed for use on crowbars, post-hole diggers, and other tools and implements on which a handle may be of temporary or permanent service, the handle being easily applied or removed, not liable to be injured when in use, and arranged to insure a firm grip.

NAIL-HOLDING ATTACHMENT FOR HAMMERS.—E. H. PLATNER, Mount Vernon, Iowa. The purpose of Mr. Platner's invention is the provision of a new combined hammer and nail-holding attachment which is simple and durable in construction, the same being designed for holding a nail in position and slanting it into material preparatory to driving it home by the hammer proper.

HORSE-RELEASER.—G. H. SLATTERY, Jacksonville, Fla. In this instance the invention refers to improvements in devices for automatically releasing fire-department, fire-patrol, and police-patrol horses upon the sounding of an alarm, the object being to provide a releaser having few parts liable to get out of order, and that will operate with absolute certainty.

SECTIONAL CASE.—O. O. BUICE, Montgomery, Ala. The intention of this improvement is to provide a case designed for use as a bookcase, show-case, or like article and which permits of secure interlocking of the units and convenient manipulation of the door to move the same into a closed or open position and when in this position to be completely out of the way of the user of the case.

VENTILATOR.—F. M. THOMPSON, East Liverpool, Ohio. The intention of this inventor is to provide means whereby to deflect the wind into a room, so that when the wind is blowing in the direction at right angles to the window-opening it may be deflected into the room, and the invention will be found especially desirable where windows open into passages between two structures.

WELL-DIGGING APPARATUS.—T. E. LAW, Kingston, Mo. The apparatus comprises a frame mounted to travel in a circular path with the well tube as a center. A traction wheel contacting with the ground serves to drive an operating shaft, the latter comprising a driving and a driven section. Novel devices are provided for causing either a periodical movement to the driven section when a reciprocating drill is employed or imparting an uninterrupted rotary motion thereto when a boring tool such as a screw is used.

VENTILATOR FOR BOOTS OR SHOES.—J. H. SANDMEYER, New York, N. Y. The purpose is to provide a ventilator for the uppers of boots or shoes, preferably placed at the side near the sole, and to so construct the ventilator that it will be readily applied and will not detract from the strength of the upper, and furthermore, to provide a perforated or reticulated front section for the ventilator, which while affording comparatively no resistance to the passage of air will serve to prevent small articles and in great measure dust from entering the shoe.

CANDY-CUTTER.—F. W. STUBBS, Manistee, Mich. The object in this improvement is to provide a candy machine that may be adjusted for cutting a variety of shapes and sizes and by means of which a large number of cuts may be made by one operation, thus reducing the cost of labor and manufacture as compared with the ordinary hand-cutters employed.

DOTTING-PEN.—E. G. RUEHLE, New York, N. Y. The purpose of this invention is to provide a dotting-pen, thoroughly effective in use and which may be conveniently and expeditiously cleaned, and so constructed that reserve dotting-wheels of various sizes may be carried in the body of the pen, and so that the dotting-wheel at the point of the pen can be readily removed to be cleaned, sharpened, and replaced.

TRUSS-PAD.—O. C. ROSS, Spokane, Wash. The object in this case is to provide features of construction for a pad which adapt it to contract the edges of the reputured wall of the groin or abdomen and so reduce the hernia that it will heal or unite at the edges, a further object being to adapt the pad in pairs for effectually compressing and supporting two ruptures that may be located high or low and either in the groin or other portion of the abdominal wall.

HOUSE-CARPENTER'S TOOL.—H. PLANTE, New York, N. Y. The object of the present patent is to enlarge the capacity of the gage illustrated in a previous patent granted to Mr. Plante so as to render the improved tool capable of use in a great number of operations in carpentry; for example, in the planing of door-jambs to enable the door to fit properly, the measurement and cutting out of panels to be inserted into the door, and other parts of the house-fittings and in the use of bead-planes generally, all of which functions are in addition to those embodied in the gage as above disclosed.

TUNNEL CONSTRUCTION.—D. PHILLIPS, Pony, Mont. In operation the false tunnel, which is divided into compartments by bulkheads each provided with a valve, while in a collapsed state, with the ties attached, is to be discharged from a vessel until extended entirely across the bed for the tunnel, and then a compartment is to be inflated, and a section of permanent tunnel built therein, after which the next section, by opening the valve, is to be inflated, the weighted cars run thereon, and another section of permanent tunnel built and joined to the preceding one, as indicated in a former patent granted to Mr. Phillips.

MATCH-SAFE.—J. H. MILLSAPS, Washington, D. C. Mr. Millsaps' invention is an improvement in match-safes, and has for an object, among others, to provide a novel construction for securing the friction-strip upon which to ignite the matches. By this invention the friction-strip can be conveniently removed whenever desired or necessary.

PRICE-TAG FOR MERCHANDISE.—W. MILLS, JR., New Rochelle, and A. E. MEDER,

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New York, N. Y. The intention of these inventors is to provide a price-tag for merchandise which is simple in construction, cheap to manufacture, easily applied, and arranged to prevent injury to the merchandise, especially when using the tag on handkerchiefs, lace goods, and like frail articles.

BOTTLE-CAP.—A. L. BERNARDIN, Evansville, Ind. The improvement relates to that class of caps which are made of hard metal and comprise an inner corrugated section to screw on the bottle-neck and an outer unthreaded section which is held to and from rotary movement upon the inner threaded section; and relates to the construction of the cap with the inner and outer sections fitted together, the inner being rather a tight fit within the outer shell, so that when the inner shell is pressed into the outer the latter will be held to and from rotary movement upon the inner threaded section.

TROUSERS-PRESS.—E. GRAHAM, Orangeburg, S. C. In this apparatus legs of trousers are creased and pressed without the aid of a hot iron. It is an improvement upon a former device for which Mr. Graham obtained Letters Patent. The present invention relates particularly to means for hinging the two frames together and providing for vertical adjustment of the upper one relative to the lower for the purpose of adapting the apparatus for pressing trousers of varying thickness or pressing two or more simultaneously.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5578.—For makers of small German silver spring wire.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5579.—For manufacturers of oil-making machinery.

American inventions negotiated in Europe. Wenzel & Hamburger. Equitable Building, Berlin, Germany.

Inquiry No. 5580.—For makers of machinery patented by M. M. Lyall, for making seamless bags.

Patent rights for driving chain for sale. German invention. Fully protected in America. Address inquiries to J. J. Kirberg, 114 Broadway, Paterson, N. J.

Inquiry No. 5581.—For parties to manufacture a display card for lace trimmings, dress goods, etc.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5582.—For makers of a dust protector for the eyes and nose.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5583.—For information regarding the lockout system in telephones.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5584.—For parties dealing in the seeds of catalpa trees or the trees themselves.

Partners for Foreign Patents Wanted.—Incubator-brooder, a money-making combination. Entirely new principle. Half interest. Chas. H. Sperle, Bound Brook, New Jersey.

Inquiry No. 5585.—For manufacturers of steel collar springs.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5586.—For manufacturers of a pocket lighter or lamp, shaped like a pencil.

Inquiry No. 5587.—For manufacturers of souvenir novelties made from photos.

Inquiry No. 5588.—For makers of glass bottles with a cork and metal screw top.

Inquiry No. 5589.—For manufacturers of punches and dies for lamp burners.

Inquiry No. 5590.—For the manufacturers of the "Gem Egg Separator."

Inquiry No. 5591.—For the manufacturers of Cole's patent geared crank lift for drop stamp.

Inquiry No. 5592.—For a gun for testing the breech pressure of gunpowder.

Inquiry No. 5593.—For manufacturers of coin-counting and wrapping machines.

Inquiry No. 5594.—For an apparatus for heating furnaces with liquid fuel.

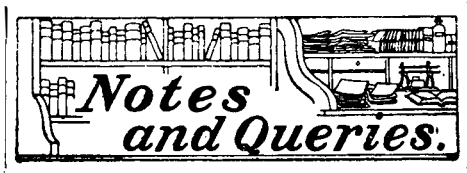
Inquiry No. 5595.—For a brass, nickel or aluminium case, constructed similar to a match box, opening near top of case, but must be a trifle larger than a match safe, about 3 inches long, 2 inches wide and ¾ inch through.

Inquiry No. 5596.—For parties engaged in metal stamping and forming, cut with dies.

Inquiry No. 5597.—For machines for weaving hats of straw or palm leaves.

Inquiry No. 5598.—For a small rock crusher

Inquiry No. 5599.—For manufacturers of leather satchels, such as upholstered tool bags, 20 inches long.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9401) E. G. says: I am perplexed with the following problems, and so take advantage of your notes and query column. 1. In photo-trichromatic printing: (a) Kindly explain what Koenig's diagrams (corrected by Capt. Abney) of the three primary color sensations really try to show. How are the curves constructed? (b) Images that we look at are formed inverted on the retina. How is it then, that we see them correctly? A. We have not at hand any description of Koenig's "Diagram Corrected by Captain Abney, of the Three Primary Color Sensations," and so are unable to give you the information concerning it which you ask. (b) It is true, as you say, that the images formed upon the retina in the eye are inverted with reference to the objects from which they are derived, but no person has ever come to the knowledge of that fact except by instruction. He could never have found it out by himself alone, from his own sensations or experience. The explanation commonly given to this curious phenomenon is that we are conscious of our own erect attitude and call the directions up and down as they seem to us, and therefore we consider up and down with reference to other objects the same as up and down with reference to our own person. 2. In physics: Why is it that a pendulum will not describe a plane surface but a conical one in its oscillations? A. The reason why a pendulum ball hung by a cord usually changes its swing into a conical surface, is that the place of the suspension of the cord in some way acts upon the pendulum unequally. Thus, if we could drill a perfectly round hole in a plate, equally smooth on all its edges, and pass through it a cord or wire which exactly filled and fitted the hole, so that the pendulum in all parts of its swing would bear equally upon the hole, it is not at all likely that the pendulum would change from swinging back and forth in a true plane. We should answer your question then, "Why is it that a pendulum will not describe a plane surface but a conical one in its oscillations?" by saying that it will, if you will give it a chance to do so. Of course, a pendulum hung by a rigid rod is forced to describe a plane surface in its oscillations. Only a pendulum hung by a flexible cord or wire can change to a conical swing. 3. If a resistance box be introduced in an electrical circuit, how will the potential of the current before entering and after leaving the resistance box be effected? A. The introduction of the resistance box into an electric circuit does not change the potential of a current in any way. It does, however, change the resistance between the two poles of the circuit, so that the drop of potential along that portion of the circuit in which the box is placed is changed. Thus, if the resistance of the piece of apparatus were 50 ohms, and the circuit is one of 110 volts, in order that 1 ampere should flow, we must have a total resistance of 110 ohms, and as there are but 50 in the apparatus there must be 60 ohms, added from the resistance box to produce this effect. The principles upon which this acts are, first, that the drop of potential in any part of an electric circuit is proportional to the resistance of that part of the circuit, and second that the current depends upon the ratio of the voltage to the resistance, according to Ohm's law. Now to answer your question: The resistance box forms a part of the circuit. Its resistance, plus the resistance of the rest of the circuit, constitutes the total resistance over which the drop of potential is to be distributed, and according to the first principle stated, the drop of potential in each of these two portions is proportional to the resistance of each portion of the circuit. As an illustration, if a circuit has its resistance in two parts 20 ohms and 30 ohms, there will be 50 ohms in the total circuit, and two-fifths of the drop will be in the 20 ohms and three-fifths in the 30 ohms. If, now, the voltage is 100, the drop in the 20 ohms will be two-fifths of 100, or 40 volts, and the drop in the 30 ohms will be three-fifths of 100 or 60 volts. 4. When a wire on the armature of a dynamo makes an angle of 0 deg. with the lines of force of the magnets, is the induced current in the wire at its maximum or minimum? A. The induced E. M. F. of a coil of the armature of a dynamo is at its minimum when the coil is under the brushes of the commutator. It is at a maximum at 90 deg. from this position, since there the number of lines of force are changing most rapidly. This coil makes an angle 0 deg. with the lines of force between the pole pieces. As the E. M. F. is at a maximum, so also, the current may be said to be at a maximum in a coil at 0 deg. with the lines of force.

(9402) E. L. A. says: Will you, through your inquiry column of the SCIENTIFIC AMERICAN, give me the easiest and best process for dissolving flower of sulphur? A. Sulphur dissolves easily in carbon bisulphide and readily in chloroform, benzole, and turpentine.

NEW BOOKS, ETC.

THE MANUFACTURE OF IRON AND STEEL TUBES. By Edward C. R. Marks, Associate Member of the Institution of Civil Engineers, etc. Manchester, England: The Technical Publishing Company, Ltd., 1903. 12mo.; pp. 156. Price, $2.

The writer confines his discussion to butt and lap welded tubes of iron, open or close jointed and consolidated tubes, and processes and appliances for the production of seamless steel tubing. The many illustrations appearing throughout the work were prepared from the drawings attached to the printed patent specifications. In addition to the table of contents there is a comprehensive index which makes any desired information readily accessible. The work is an outgrowth of a series of lectures delivered by the author before the Birmingham Municipal Technical School. It should prove a useful handbook for manufacturers and others interested in the subject of iron and steel tubes.

ELEMENTE DES WASSERBAUES. Fuer studierende an hoeherer Lehranstalten und juengere Teckniker. Bearbeitet von Eduard Sonne und Karl Esselborn. With 226 illustrations. Leipzig: Wilhelm Engelman, 1904. 8vo.; pp. 337.

DER WASSERBAU. Nach den Vortraegen gehalten am Finnlaendischen Polytechnischen Institute in Helsingfors. Von M. Strukel. IV. (letzter) Teil. Leipzig: A. Twietmeyer. 1904. Sq. 8vo.; pp. 200 and 37 plates.

Both of these works cover pretty much the same field and are written quite in the same vein. Both are intended for post-graduate students and young engineers. We are unable to judge of the relative merits of the two works, for the reason that we have before us only the fourth part of Prof. Strukel's papers, discussing dikes, harbors, and the like. The work of Prof. Sonne and Prof. Esselborn seems to us in every way a most excellent text book, prepared with characteristic German thoroughness and in every way adapted for the purpose for which it was written. Prof. Strukel's discussion is considerably fuller and will for that reason probably find no slight appreciation among practising engineers.

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AND EACH BEARING THAT DATE

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Bag holder, A. M. Harris	760,690
Basket making machine, E. Horton	760,791
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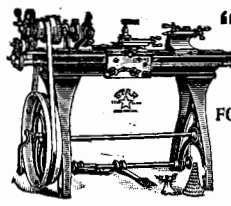

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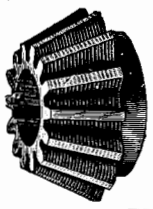

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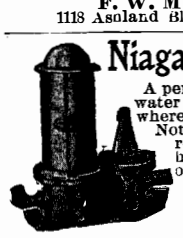

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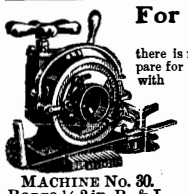

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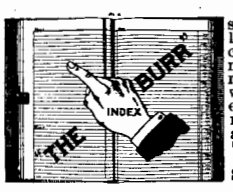

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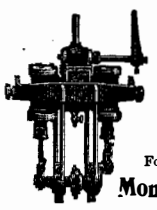

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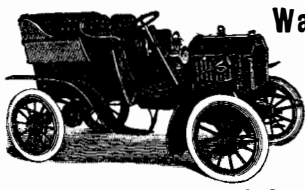

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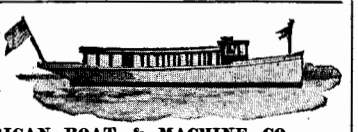

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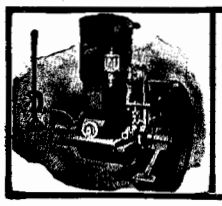

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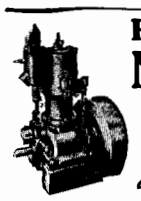

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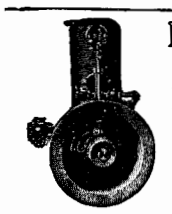

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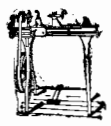

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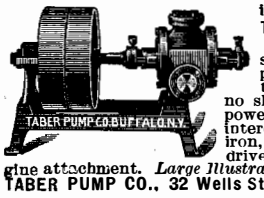

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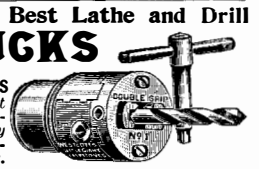

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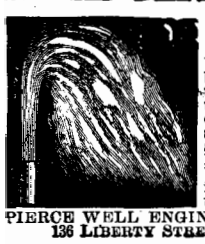

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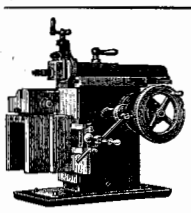

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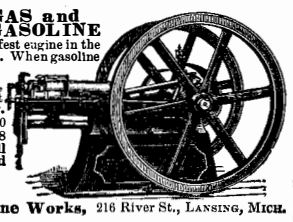

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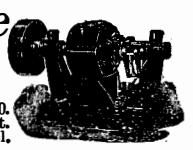

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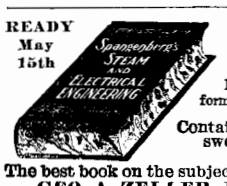

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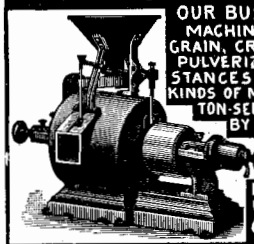

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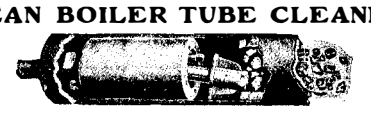

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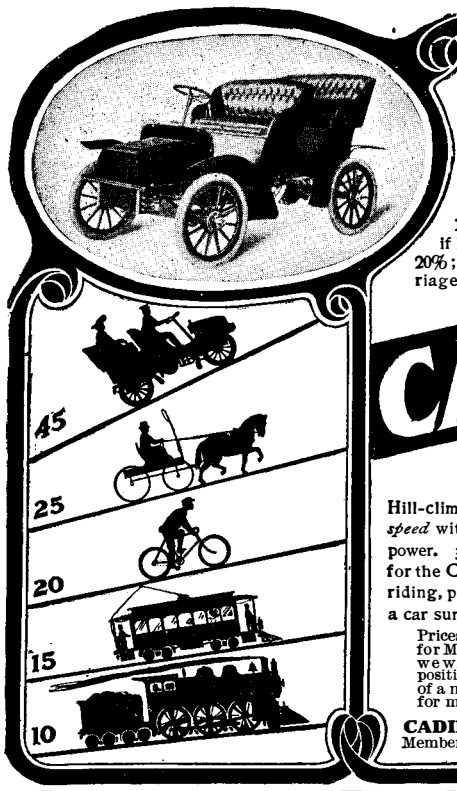

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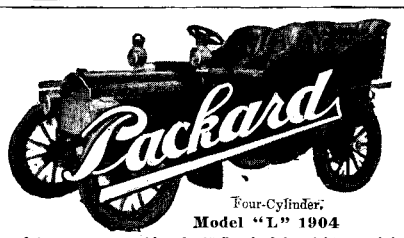

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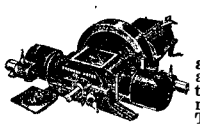

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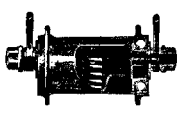

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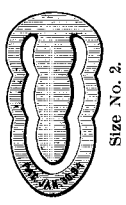

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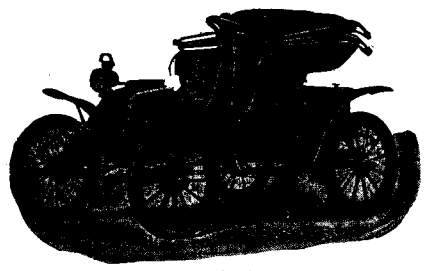

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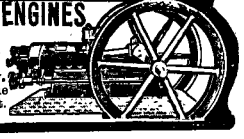

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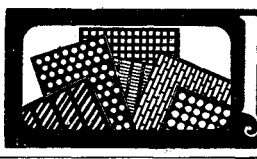

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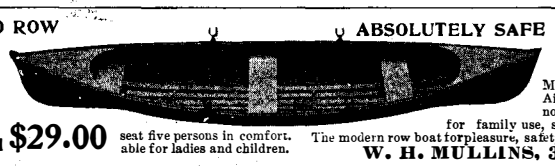

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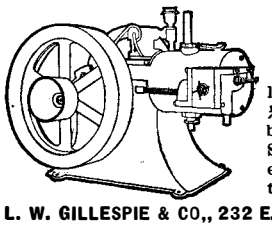

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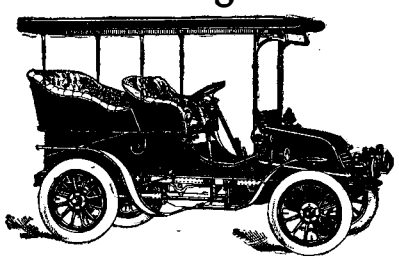

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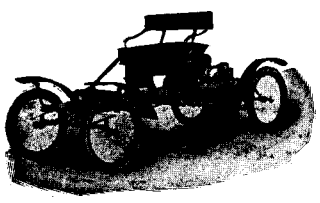

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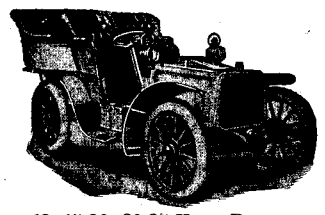

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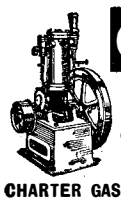

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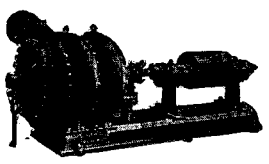

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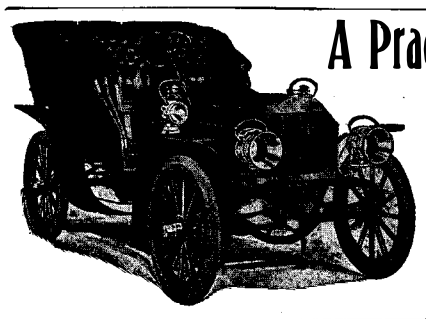

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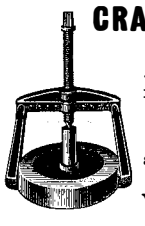

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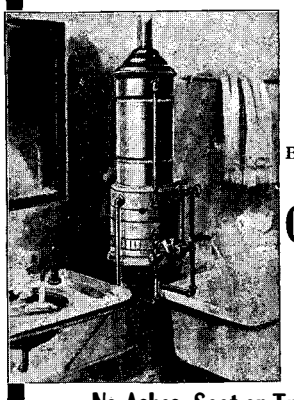

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